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The Measurement of Investment Center Managerial Performance Within Selected Diversified Industrial Firms: an Inquiry.

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THE MEASUREMENT OF INVESTMENT CENTER MANAGERIAL PERFORMANCE WITHIN SELECTED DIVERSIFIED INDUSTRIAL FIRMS: AN INQUIRY

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ABSTRACT

Return on investment and residual income are measurement tools that are widely used in the internal assessment of investment center managerial effectiveness. In initiating this type of performance evaluation, the necessity of internal authority and responsibility segmentation causes application difficulty that is not experienced when evaluation is confined exclusively to the firm level. Basically, the problems involved in subentity managerial assessments consist of tool "unfairness" due to an absence of coordination between segment manager activity and effective measurement of the same, tool "indecisiveness" caused by a lack of measurement distinction between controllable and noncontrollable elements, and tool "incongruency" evidenced by a conflict in optimal decision motivation between segment and top management. The contention of this study was that all three problem areas are deeply rooted within the context of procedures utilized in accordance with generally accepted accounting principles. On the basis of this premise, the objective of this research was to conduct an inquiry into the methods used by industrial corporations in their evaluation of investment center managerial performance, and after completing this inquiry, to recommend improvements in the procedures presently utilized. As such, the dual

hypotheses which formed the basis of this study were as follows:

1. The measurement criteria presently used in assessing the effectiveness of investment center managerial performance is influenced too strongly by generally accepted accounting principles to be an internally meaningful evaluation, and

2. Too much reliance on generally accepted accounting principles causes distortions in the evaluative process and may result in misdirected managerial motivation with respect to optimizing total company performance.

The evidence accumulated in this study by means of literature examination, an inquiry questionnaire, and a computer sensitivity analysis was sufficient to affirm the general validity of both hypotheses. Definite proof of substantial reliance on externally-oriented accounting principles was provided by the questionnaire as well as literature and sensitivity based illustrations of measurement base distortion and suboptimal motivational potential that can arise as a result of using procedures in accordance with these external principles. The primary cause of both distortion and suboptimal consequences was attributed to the emphasis placed on inappropriate profit goals coupled with the basic unfairness of the resulting tool measures.

On the basis of this study's findings, recommendations, intended to provide a fair and effective base for managerial

performance assessment, were synthesized. The primary recommendation focused on the need to establish internal measurement standards and included the concepts of relevance, operational independence, co-variability, and goal congruency as guideline considerations. In addition, specific measurement procedures were recommended that emphasized divisible managerial responsibility, controllable profit and resource derivations, and the need for current valuation of included base elements. Finally, the conclusion was reached that only the residual income tool could be effectively applied in the performance assessment of an investment center's management, and in this respect, a residual income performance index was designed for purposes of internal result comparisons.

Chapter 1

INTRODUCTION TO THE STUDY

Return on investment and residual income are two evaluative tools that are widely used to measure management effectiveness; however, these tools also have numerous other applications. Internally, they are used to assess the performance of a firm's segments as well as their management, and they are used to evaluate capital investments. In addition, these same tools are widely used as external measures of the firm's overall financial performance. On a macro or corporate level, the foremost problem in applying these concepts is the definition and determination of "income" and "investment base." When these concepts are instead applied on a micro or segmental level, the problems due to segmentation are far more intense. In addition to the difficulties mentioned above, the very basis and implications of these tool measures are subject to challenge on several grounds when they are used to evaluate segment management.

CHALLENGES TO THE MEASURES

Measurement Tool Fairness

Tool fairness is questioned from the point of view of the segment manager whose performance effectiveness is

assessed. The crux of this questioning arises from an absence of coordination between segment activity and proper evaluation of managerial effectiveness. This occurs because the measurement procedures most often applied are deeply rooted within the context of externally-oriented generally accepted accounting principles. For example, segment managers object to reduction of their segment earnings through tax minimization accounting procedures such as accelerated depreciation and L.I.F.O. inventory valuation. Although cash flow in a given year may increase through applying these measurement options, net profit (on which a manager's performance is more often evaluated) would likely decline.

Measurement Tool Indecisiveness

Indecisiveness relates in part to the above mentioned questioning of fairness in that the measurement devices presently used often include factors that are doubtful from the point of view of segment manager controllability. This is evidenced by the use of cost allocation procedures (in accordance with the concept of "full" product costing) to assure that each corporate segment bears its relative share of all corporate committed and discretionary costs. Performance indecisiveness is further complicated by the existence of shared facilities and intersegment relations. The importance of this indecisiveness challenge lies in the fact that return on investment and residual income are

used exclusively by many firms as the sole basis for determining segmental incentive bonus awards. Also, it becomes obviously misleading to compare one segment with another for purposes of determining the "best" segment management.

Measurement Tool Incongruency

Extension of the above analysis leads into the last major difficulty--this is, a lack of congruency often exists in optimal decision making between the macro system (firm level) and its micro subsystems (segment level) in a decentralized corporation. The measurement of segmental performance and the rating of segment management based on return on investment and residual income as presently calculated may create situations in which conflict of interest arises. For example, a segment manager may make a decision not to replace existing facilities, a decision which is likely to benefit his short-run performance but which could represent a detrimental decision from the company's long-run viewpoint--or, a decision affecting the relations between segments such as intersegment transfers may increase the earnings of one segment at the expense of another and perhaps also at the sacrifice of the corporation as a whole. Situations arising relative to the above can easily lead to corporate suboptimization. This is especially true if profitability is assumed to be a primary goal and if return on investment and residual income are

reinforced as primary decision inputs. Subsequent chapters will fully explore this potential suboptimization problem.

GENERALLY ACCEPTED ACCOUNTING PRINCIPLES INTERNAL MEASUREMENT UTILITY

From the foregoing discussion, it would appear that the problems of fairness, indecisiveness and congruency are rooted within the context of generally accepted accounting principles--more specifically, in the utilization of procedures flowing from these externally-oriented principles for purposes of internally-oriented measurements. This section briefly examines the relevance of generally accepted accounting principles from an internal viewpoint. Much of the information that follows is drawn from and based upon research performed by Solomons.[1] According to Solomons, the framework of accounting is composed of the following concepts:

Entity Concept
Continuity Concept
Monetary Measurement Concept
Cost, Realization and Matching Concepts
Objectivity Concept
Consistency, Disclosure and Materiality Concepts
Conservatism Concept

In the discussion that follows, each of the above concepts is analyzed in order to assess its degree of utility or usefulness for internal measurement purposes. In conducting

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[1]David Solomons, Divisional Performance: Measurement and Control (New York: Financial Executives Research Foundation, 1965), pp. 40-57.

this analysis, comparisons are also made between external and internal utility applications.

Entity Concept

The definition of the "entity" is based upon a legalistic economic activity approach and encompasses the idea that economic activity is carried on through specific units or entities. Thus, the accounting entity in an external sense is defined in terms of legal organization (i.e., the corporation). For purposes of internal measures, legal entities have little significance. Instead sectors within a firm such as responsibility centers bear far greater importance. In addition, it is vital to distinguish between various types of internal entities because these entities often serve different purposes. For example, if one is trying to evaluate the performance of a person, the entity should be defined by reference to the person bearing the responsibility for it. If instead, one wishes to evaluate the performance of an activity (as distinct from the person responsible for it) the boundaries of the entity must be redefined by reference to activity center segments (i.e., market regions, product lines). The significance of these distinctions lies in the fact that information collected for one kind of entity evaluation may not be appropriate for another. In order to reconcile internal entities with the external legal organization entity, a "fictitious" corporate segment--the

missing link--is often created in order to recognize synergistically that the whole is greater than the sum of its component parts.

Continuity Concept

A further observation regarding the nature of the accounting entity is that the life of most economic units is not determinable. Therefore, under the going-concern concept, the premise is taken that unless evidence exists to the contrary, the entity should be viewed as remaining in operation indefinitely. Generally speaking, with internal measurements, the continuity concept should be eliminated as a guiding principle. Not only do terminable entities play a more important role in internal reporting, but reinforcement for the use of historical cost generally finds its support in the continuity concept.

Monetary Measurement Concept

The monetary measurement concept establishes money and specifically the dollar as the common denominator of accounting measurement. The most serious limitation pertinent to both external and internal measures is the implicit assumption that the monetary unit remains stable over time. Although until recently arguments have been brought forward to defend a "do nothing" attitude regarding the purchasing power of the dollar in external reporting, internally, the matter is entirely in the firm's own hands

since it is not limited by S.E.C., I.R.S., or auditor certification constraints. Furthermore, the monetary measurement concept does not imply that measures in non-monetary terms have no place in accounting. On the contrary, the smaller the segment or internal entity, the more likely it should be for nonmonetary measures to supplement or even replace some monetary measures. Although this idea seems to be logical, the questionnaire results associated with this study seldom refer to the use of nonmonetary measures in formulating assessments of segmental managerial effectiveness.

Cost, Realization and Matching Concepts

The above three concepts, considered together, identify the external accounting approach to the measurement of profit. For internal purposes, the primary question relative to the above profit measure is: how well does each year's profit reflect the successful performance of that year's manager? For example, it is quite possible for two managers to show identical profits or even identical rates of return in the short run and yet experience quite different degrees of success as a manager. One manager may be building up the foundations of a growth-oriented segment while the other manager may be squandering his segment's accumulated goodwill. Neither of these actions is likely to show in the current profit calculations. For internal assessments, this shortcoming is serious, especially when

profit is used as a measure of managerial effectiveness for directing a segment. Furthermore, it should be noted that only under conditions of unusual stability will profit, as measured in accordance with generally accepted accounting principles, satisfactorily reflect short-run managerial effectiveness. This raises doubt as to the reliability of the overall segment profit measure as a success indicator.

Objectivity Concept

In an attempt to produce external reliability, accountants have turned to the concept of objectivity. The following are the two sides of the objectivity coin:

Verifiability. This concept implies independent verification of results. Independent verification is generally agreed to be an outstanding quality of historical cost, since this cost is derived from a past transaction which can be ascertained and verified.

Freedom from bias. This concept implies that the resulting measurements are independent of the measurer's personal bias.

From an internal point of view, only the second side of objectivity appears to be applicable. In fact, the concept of objectivity as a whole should be delegated to a secondary role in the development of accounting data. In its place as a primary concept should be inserted the standard of "relevance." Choosing objectivity at the cost of relevance (i.e., historical cost is strong on objectivity

but often weak on relevance) is inexcusable in internal accounting because the users of the resulting information are known and presumably are highly knowledgeable about the business operations.

Consistency, Disclosure and Materiality Concepts

The above concepts are so closely interrelated that it is best to consider discussion of them in one section. The concept of consistency refers to both consistency in the use of accounting procedures over several accounting periods and internal procedural consistency for handling similar items in the same way within the same accounting period. The real danger is not so much a lack of consistency as it is a lack of proper disclosure of accounting changes. While undisclosed changes can be highly misleading, disclosed changes should clarify areas where possible misinterpretation could occur. In conjunction with the above, the materiality concept seeks to identify data that should be disclosed. Within this framework, an item is regarded as "material" if there is reason to believe that an informed user's decision would be influenced by the substance of the data. Materiality differs from relevance in that the former refers to the "significance" of data within a specific context, while the latter refers to the "context" itself. Regarding internal versus external viewpoints, the primary difference involves the importance that should be attached to the consistency concept.

Internally, much less significance should be attached to consistent application of accounting procedures. Instead, segmental decision autonomy should determine which accounting procedures best reflect the peculiarities of segmental activity.

Conservatism Concept

The environment of uncertainty has provided a basis for conservatism in accounting; however, conservatism often serves as a constraint to the presentation of information that otherwise might be relevant. At best, conservatism is a poor method of coping with the existence of uncertainty in valuation and income.

Concept Summary

The traditional approach in establishing accounting principles has assumed a climate of unknown users within a complex, uncertain environment. Little attention has been devoted to the question of whether accounting concepts, appropriate to the needs of external users, are also appropriate to the needs of internal management. In 1966, a major breakthrough with respect to this distinction occurred when the Committee to prepare A Statement of Basic Accounting Theory defined accounting in such a way so that the concept of relevance became the primary standard.[2]

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[2]Committee to Prepare a Statement of Basic Accounting Theory, A Statement of Basic Accounting Theory (Illinois: American Accounting Association, 1966), p. 7.

Implicitly, the recognition of relevance as the primary standard necessitates that a distinction be drawn between the needs of internal and external users, as information relevance would vary accordingly. Unfortunately, in practice this distinction has not been sufficiently recognized, as evidenced by a suspected strong internal reliance on generally accepted accounting principles for performance measurement purposes.

RESEARCH OBJECTIVE AND SCOPE

The objective of this study is to investigate the relationships that exist between the central management of a diversified corporation and the management of its internal segments; and, as a result of such investigation, to arrive at recommendations which should result in more effective coordination and control of segmental operations in accordance with the objectives of the corporation. Stated in its simplest terms, the question to which this study addresses itself is: how should diversified firms measure and evaluate the performance effectiveness of managerial segments? In seeking a solution, this study will synthesize and recommend improvements in currently-existing segmental measurement devices with the overall objective of improving the measurement of managerial effectiveness. This will involve an examination and assessment of the fairness and adequacy of the context and

composition of the tools presently used.

The scope of this examination will emphasize the measurement problems as experienced by our largest multi-segment industrial corporations as identified by Fortune.[3] The overall difficulties of segmental profit determination and investment base derivation will be analyzed along with the specific problems associated with segmental cost allocations and intersegment transfers. The above focal areas will be examined within the composite problem involving micro suboptimization of macro objectives.

In order to maintain scope manageability, the following scope limitations have been interjected:

1. Return on investment and residual income will be examined regarding their fairness and effectiveness as managerial performance evaluative tools, not from any other point of view reflecting alternative applications of these tools.

2. In this study, no attempt will be made to examine the problems of non-segmented entities or non-industrial organizations, although some of the problems and ultimate findings certainly can be generalized as applicable to these corporations. Also, the nature of this study

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[3]See "Directory of the 500 Largest Industrial Corporations," Fortune, May, 1974, pp. 230-257.

The Fortune directory of the top 500 industrials (size as a function of total dollar sales) is published on an annual basis.

automatically excludes non-profit organized corporations.

3. Specific topic areas will be examined that in themselves constitute entire research study proposals. As such, no attempt can possibly be made to completely resolve all the problem areas that will subsequently be identified. An example of the above is the area of transfer pricing.

It must be emphasized that this study applies only to integrated, multisegmented, industrial firms because generalizations will be advanced that are not applicable to smaller firms, firms without segments or firms with relatively independent, semiautonomous units whose performance is only assessed over a span of years. In all such cases, return on investment and residual income are not usually applied, transfer prices are not involved, and there is little or no problem of optimizing relationships between various internal components.

STATEMENT OF THE HYPOTHESES

This research endeavor can be summarized as consisting of inquiry, comparative analysis and recommendation synthesis. Within this overall framework, this study will attempt to determine the validity of the following assertions:

1. The measurement criteria presently used in assessing the effectiveness of investment center managerial performance is influenced too strongly by generally

accepted accounting principles to be an internally meaningful evaluation, and

2. Too much reliance on generally accepted accounting principles causes distortions in the evaluative process, and may result in misdirected managerial motivation with respect to optimizing total company performance.

RESEARCH DESIGN

The research approach utilized in this study consisted of three interrelated phases:

Review of Existing Literature

This review was undertaken in order to provide for a general discussion of the segmented entity as well as of its evaluative devices. In addition, this review aided in determining input inquiry questions for the questionnaire survey.

Questionnaire

An inquiry questionnaire was mailed to the 500 largest industrial corporations as listed in the May, 1974 issue of Fortune. The firms surveyed accounted for 65 percent of all U. S. industrial sales and 79 percent of all profits during the year 1973.[4] For control purposes, each survey was visibly coded. Corporation mailing information was

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[4]Ibid., pp. 230-232.

obtained by reference to Moody's Industrial Manual.[5] A copy of both the cover letter of transmittal and questionnaire survey can be located in APPENDIX A. The overall objectives of this questionnaire were:

1. To determine the manner in which corporations classify their segments for performance responsibility purposes--more specifically, to assess the extent to which these firms utilize the "investment center" responsibility concept,

2. To determine the nature of the measurement tools used to assess segmental managerial performance and to determine how firms having investment centers measure the size of profit and investment base, and

3. To provide input data for the sensitivity analysis that was subsequently developed utilizing trends from the survey responses.

With respect to the questionnaire response, TABLE 1 (page 16) provides a complete breakdown of responses received by both sales volume and industry grouping. TABLE 1 shows that 60.4 percent or 302 firms returned a completed questionnaire on a first response solicitation. In addition, not shown in this table is the fact that 20 firms responded to this survey inquiry but did not complete

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[5]See "Geographical Index," Moody's Industrial Manual (New York: Moody's Investors Services, Inc., 1973), pp. 3a-36a.

TABLE 1

ANALYSIS OF QUESTIONNAIRE RESPONSES BY INDUSTRY GROUPING AND FIRM SIZE

INDUSTRY GROUPING	FIRM SIZE (1973 SALES VOLUME)							Total Number of Firms	Percentage Rates
	Less Than $200 Million	$200 Million but Less Than $350 Million	$350 Million but Less Than $500 Million	$500 Million but Less Than $800 Million	$800 Million but Less Than $1 Billion	$1 Billion but Less Than $2 Billion	$2 Billion and Higher		
Appliances/Electronics . . .	3	6	2	2		3	1	17	5%
Chemicals/Pharmaceuticals. .	3	3	8	8	3	5	7	37	12%
Communications	1	2	3					6	2%
Computers/Office Equipment .	2		1			2	3	8	3%
Food/Beverages/Tobacco . . .	2	8	7	6	4	8	5	40	13%
Industrial Equipment	2	12	5	3		4	3	29	10%
Leisure/Sporting Goods . . .	2		3		1			6	2%
Paper/Paper Products		7	3	3	2	2	2	19	6%
Petroleum Products/Refining.		2	1	2	2	2	14	23	8%
Scientific/Aerospace		2		1			5	8	3%
Textiles/Apparel	4	6	5	5	1		1	22	7%
Vehicles/Vehicle Parts . . .	1	7	5	6	1	4	5	29	10%
Wood Products/Construction .	1	5	6	3		3	1	19	6%
Metals/Other Industries. . .	2	8	2	10		9	8	39	13%
Total Number of Firms. . . .	23	68	51	49	14	42	55	302*	
Percentage Rates	8%	23%	17%	16%	4%	14%	18%		100%

*Out of a total sample of 500 firms, 302 completed questionnaires were received, providing a total rate of return of 60.4%.

a questionnaire for various reasons. The foremost reason cited was that corporate policy in opposition to external solicitations prevented them from doing so. In essence then, the total response rate by those firms acknowledging this inquiry was 64.4 percent. Due to this favorable initial response, no further solicitation was thought to be necessary.

Sensitivity Analysis

Incorporating output trend data from the questionnaire with input financial information from a selected segmented corporation (who wishes to remain anonymous), a sensitivity analysis was performed through use of a computer. This analysis began by establishing initial return on investment parameter values based on this corporation's existing situation. TABLE 2 (page 18) and TABLE 3 (page 19) outline the balance sheet and income statement information that was used in setting these initial ROI parameter values. Subsequent phases involved testing these parameter values for sensitivity by altering the input information. These test phases involved F.I.F.O. to L.I.F.O. conversion, equipment replacement and leased assets. The overall objectives of this sensitivity analysis were:

1. To illustrate for reader visualization the vast array of performance result diversification that is inherent in the return on investment calculation, and

2. To synthesize recommendations for improvement in

TABLE 2

1974 BALANCE SHEET ($000 OMITTED)

DATA FOR CORPORATION USED IN SENSITIVITY ANALYSIS	CORP. TOTAL	CORP. SEGMENT	PRODUCT-GROUPS		INDUSTRIAL PROD-LINES		
			CONSUMER	INDUSTRIAL	PLAS-TICS	CHEM-ICALS	SYNTHE-TICS
Assets							
Current Assets:							
Cash	990	9	417	564	124	237	203
Intrafirm Receivables		(482)		482		482	
Trade Receivables	2,682		1,046	1,636	575	461	600
Inventories	6,028	(140)	2,651	3,517	467	1,500	1,550
Tot. Current Assets	9,700	(613)	4,114	6,199	1,166	2,680	2,353
Plant Assets:							
Nondepreciable, at cost	640	400	22	218*			
Depreciable, at cost	10,400	340	3,260	6,800	1,900	3,900	1,000
Total, at Cost	11,040	740	3,282	7,018*	1,900	3,900	1,000
Less: Acc. Depr.	4,640	200	2,030	2,410	410	1,950	50
Tot. at Book Value	6,400	540	1,252	4,608*	1,490	1,950	950
Other Assets	500	500					
Total Assets	16,600	427	5,366	10,807*	2,656	4,630	3,303
Equities							
Current Liabilities:							
Intrafirm Payables		(482)	250	232	100		132
Trade Pay. & Accrued.	5,045		2,522	2,523	856	1,134	533
Tot. Current Debt	5,045	(482)	2,772	2,755	956	1,134	665
L-T and Deferred Debt	2,816	909	1,689	218*			
Total Liabilities	7,861	427	4,461	2,973*	956	1,134	665
Stockholders' Equity	8,739		905	7,834	1,700	3,496	2,638
Total Equities	16,600	427	5,366	10,807*	2,656	4,630	3,303

*Denotes partial or complete nonallocation of figures to product-line segments.

TABLE 3

1974 INCOME STATEMENT ($000 OMITTED)

DATA FOR CORPORATION USED IN SENSITIVITY ANALYSIS	CORP. TOTAL	CORP. SEGMENT	PRODUCT-GROUPS		INDUSTRIAL PROD-LINES		
			CONSUMER	INDUSTRIAL	PLAS-TICS	CHEM-ICALS	SYNTHE-TICS
Revenues:							
External Net Sales. . .	24,540		10,430	14,110	3,104	5,926	5,080
Internal Transfers. . .		(2,000)		2,000		2,000	
Other Revenues.	360		130	230*	10	100	90
Tot. Revenues	24,900	(2,000)	10,560	16,340*	3,114	8,026	5,170
Variable Exp. Controlled:							
Internal Transfer Cost.		(1,600)		1,600		1,600	
Cost of Goods Sold. . .	14,100		6,500	7,600	1,018	3,777	2,805
Mkt. and Gen. Expense .	3,967		1,664	2,303	517	948	838
Tot. Variable Exp . .	18,067	(1,600)	8,164	11,503	1,535	6,325	3,643
Contribution Margin . . .	6,833	(400)	2,396	4,837*	1,579	1,701	1,527
Controlled Fixed Expense:							
Depr. on Control. Inv .	500		210	290	110	160	20
Segment Overhead. . . .	2,940		1,090	1,850	900	290	660
Tot. Control. Fixed .	3,440		1,300	2,140	1,010	450	680
Performance Margin. . . .	3,393	(400)	1,096	2,697*	569	1,251	847
Uncontrolled Fixed Exp.:							
Segment Overhead. . . .	282		30	252	22	130	100
Segment Margin.	3,111	(400)	1,066	2,445*	547	1,121	747
Shared Expenses:							
Joint Fixed Costs . . .	313	123	180	10*			
Incremental Central . .	425		179	246	54	103	89
Tot. Allocated Exp. .	738	123	359	256*	54	103	89
Net Income Before Taxes .	2,373	(523)	707	2,189*	493	1,018	658
Taxes on Income	1,290		222	1,068	218	531	319
Net Income After Taxes. .	1,083	(523)	485	1,121*	275	487	339

*Denotes partial or complete nonallocation of figures to product-line segments.

the internal measure of segmental managerial performance.

A copy of both the computer program and output results relative to the above sensitivity analysis can be located in APPENDIX B. In addition, output result analysis together with questionnaire tabulations are incorporated in the remaining chapters in this study. With respect to interpretative analysis of the questionnaire and sensitivity study, assurance was given to all participating firms that their individual responses would be held in strict confidence, and that any data reported would be included in tables without disclosure of specific companies. Disclosure of results in this confidential manner has been fully adhered to.

TERMINOLOGY

A difficulty encountered in compiling this study involved the selection and consistent application of various terms. The following are the definitions of key terms used in this study. Other terms will be defined in subsequent chapters when it is more appropriate to do so:

1. Diversified: A diversified firm is one which possesses two or more identifiable segments of distinguishable characteristics.

2. Effectiveness: Effectiveness evaluates the relative ability of a firm or firm segment to achieve a predetermined goal. In this study, effectiveness is not

intended to be considered as synonymous with the term "efficiency" the latter meaning achieving some output utilizing a minimum of effort, expense or waste. Thus, as interpreted here, one of a maximum of four performance combinations may prevail in a given managerial evaluation:

Segment management may be both effective and efficient, or

Segment management may be effective, but not efficient, or

Segment management may be efficient, but not effective, or

Segment management may be both ineffective and inefficient.

3. Segment: The term segment designates the performance components within a diversified company. The primary prerequisite is that the designated components be classifiable responsibility-wise as investment centers. As such, segments are accountable to top management not only for profitability, but also asset utilization in this profit earning process.

4. Intersegment: Intersegment describes transactions or other forms of interactions existing between segments of a firm. This term carries essentially the same meaning as the term "intracompany."

5. Suboptimization: Interpreted in the negative synergistic sense, suboptimization signals a lack of

congruency between firm and segmental objectives. This adverse effect is due to a combination of intersegmental relationships and faulty evaluative techniques.

ORGANIZATION OF REMAINING CHAPTERS

The remaining chapters in this study are organized as follows:

Chapter 2 involves an examination of decentralization and segmentation for operational purposes and the establishment of responsibility center evaluation parameters.

Chapter 3 discusses the context of return on investment and residual income within the framework of the internal measurement system.

Chapter 4 examines the problems inherent in profit determination and segmentation (i.e., cost allocations) and the implications of the various concepts of profit.

Chapter 5 analyzes the context and composition of the segmental investment base. Complications caused by L.I.F.O. valuation, leased assets and transfer pricing are among the topics examined.

Chapter 6, the final chapter in this study, presents the overall recommendations in conjunction with this study's findings along with concluding comments and ideas for further research.

Chapter 2

ORGANIZATION OF FIRM SEGMENTS FOR OPERATIONAL AND EVALUATIVE PURPOSES

Operational and evaluative segmentation differ to the extent that the defined organizational objective, and thus the boundary parameters, of each differs. The following sections examine each form of segmentation.

OPERATIONAL SEGMENTATION

The most prominent physical bases for operational segmentation are by geographical location, business function and product line.

Geographical Segmentation

The easiest of the three to identify is the geographical form of segmentation. Under this form of organization, a company may locate its headquarters in the north and regionalize its satellite segments in the west, east and south. Geographical segmentation is applicable in particular to the process industries, chemicals, oil refining and steel. Here, special circumstances place a premium on regionalization due to the necessity of being close to raw materials, the heavy expense of shipping finished products and the relative unimportance of large

and dispersed marketing activities.[6]

Functional Segmentation

Under the scheme of functional segmentation, each function (i.e., manufacturing, sales, finance) is directed on a companywide basis. This form of organization works best in a company that has a single product or in a company that operates in a single homogeneous region. Operationally, the functional form of organization weakens considerably when new products emerge, when subsidiaries are acquired or when new markets are tapped.[7]

Product-Line Segmentation

This last major form of operational segmentation implies managerial responsibility for all functions pertaining to the particular product-line under his jurisdiction. According to Bows,[8] one of the following basic forms of operational diversification emerges when product-line segmentation is involved:

Horizontal integration. Horizontal integration indicates that diversification is by product rather than

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[6]W. Cameron Caswell, "Taking Stock of Divisionalization," Journal of Business, 22 (July, 1956), 161.

[7]Daniel L. Kurshan, "Meaning of Decentralization," Management Record, 25 (January, 1963), 8-9.

[8]Albert J. Bows, Jr., "Problems in Disclosure of Segments of Conglomerate Companies," The Journal of Accountancy, 122 (December, 1966), 34-35.

by basic industry. Cosmetic and textile firms often utilize this form of organizational integration.

Vertical integration. Vertically integrated firms diversify their activities by industry. They do so with the singular goal of manufacturing important overall end products. For example, automobile companies frequently engage in the steel, glass and parts industries in order to attempt to control the cost and supply of the end products which these industries manufacture.

Combined integration. This form of organization--a mixture of both horizontal and vertical integration--is typical of conglomerate firms and involves widely diversified activities in different industries which manufacture numerous end products.

On the whole, product-line segmentation, regardless of the integration form it assumes, is most applicable to the multi-product, multi-market, multi-purpose, make-and-sell industrial enterprises.[9]

Of the three major operational patterns discussed, the establishment of segmental boundaries is easiest to achieve in the functional organization. However, a related problem that tends to plague functionally-oriented top management is the limited extent of decision authority that can be delegated to their segment managers. This authority

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[9]Caswell, op. cit., p. 161.

is far more restrictive or narrower than is the profit responsibility for which top management would ideally prefer to hold segment management responsible. Conversely, decision authority delegated to product-line and regional managers tends to assume a much broader base that is more consistent with their overall managerial responsibility.[10] Furthermore, FIGURE 1 shows that there is an inverse relationship between the degree of decision autonomy possessed and the number of segments a company finds essential in order to accomplish overall organizational objectives.

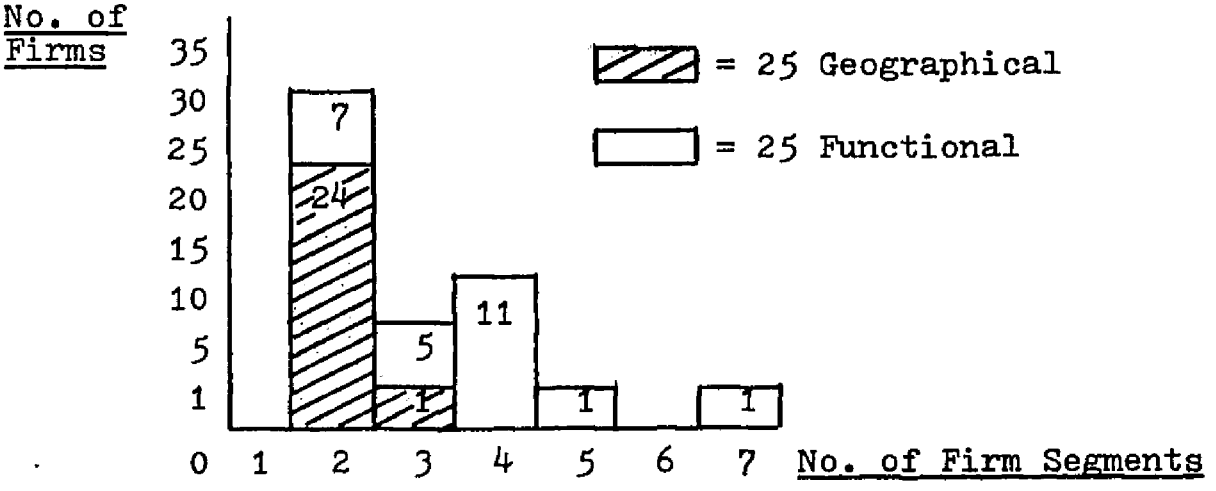

FIGURE 1

GEOGRAPHICAL VERSUS FUNCTIONAL ORGANIZATIONS

SOURCE: Adapted from an illustration by William R. Kinney, Jr., "Covariability of Segment Earnings and Multi-Segment Returns," The Accounting Review, XLVII (April, 1972), 343.

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[10]Gordon Shillinglaw, "Divisionalization, Decentralization and Return on Investment," N.A.A. Bulletin, 41 (December, 1959), 20-21.

The importance of the information shown in FIGURE 1 lies in the fact that the extent of internal company fractionalization and its degree of decentralization have much to do with the extent of common cost allocation and intersegment transfers that subsequently occur. Therefore, the more numerous and smaller are the segments involved, the greater tends to be the degree of integration among them. This higher density of integration greatly increases the probability of both common cost allocation and intersegment transfer of asset resources.

DECENTRALIZATION: THE LINK BETWEEN OPERATIONAL AND EVALUATIVE SEGMENTATION

The transition from a centralized to a decentralized structure most often occurs because the competitive environment exerts continuing pressure on management to discover methods of increasing profits. As implied above, expansion of sales of existing product lines is one possible solution; diversification into new product areas is another. Movement in either direction, and particularly the latter, is likely to eventually create congestion in the corporate respiratory system. As top management becomes increasingly more remote from the day-to-day operating problems, the old functional lines of communication and responsibility become inefficient devices for the delegation of decision-making authority. In the situation described, transition to a decentralization structure is

likely to occur.

Meaning of Decentralization

Decentralization, as the term is used today, refers to the creation of a number of semi-autonomous operating units within a company, each of which is expected to operate in substantially the same manner as a separate firm, dependent on its own profit performance for economic survival.[11] Therefore, according to noted authorities, decentralization essentially means the dispersion of decision-making authority, and thus responsibility, throughout an organization. The benefit accruing to an optimally decentralized system is that the net effect of all individual segmental decision actions would be more favorable to the firm as a whole than would be the action sets selected by any other array of decision centers.

Decentralization by its very nature encourages individuality, creativeness and freedom. Its goal is "to capitalize on the size and potential strength of the whole company, and yet give segments sufficient autonomy so that they can realize the advantages of a small or single unit business."[12]

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[11]Gordon Shillinglaw, "Problems in Divisional Profit Measurement," N.A.A. Bulletin, 42 (March, 1961), 33.

[12]George Albert Smith, Jr., Managing Geographically Decentralized Companies (Boston, Massachusetts: Harvard University Press, 1958), p. 3.

Relationship between Segmentation and Decentralization

Decentralization is the logical successor to segmentation along product or regional lines. The two differ primarily in the amount of authority delegated to the segment managers. Decentralization, in essence, adds to segmentation the concept of delegated "profit" responsibility. Conversely, segmentation adds to decentralization the operational mechanism through which the latter philosophy is most often initiated. Decentralization aims to recreate in the large organization the conditions that give life and flexibility to the small firm without sacrificing the advantages of size. Although some companies have been able to decentralize within the framework of a functional organization structure, most decentralization results from an outgrowth of dissatisfaction with the ability of functionalism to satisfy management's need to delegate decision-making authority. Therefore, it appears that a segmented form of organization paves the way for decentralization and thus tends to achieve the decentralizer's goal of having decisions controlled and implemented at relatively low levels in the organization. Naturally, no company is completely decentralized. In this respect, in order to keep decentralization from resulting in complete fragmentation, some part of the central core must remain as the unifying element. In otherwords, while top management releases the ropes which enable various movement in the

limbs of the organization, at the same time it maintains a steady grip upon a few reins which determine, to a significant degree, the direction and speed of business activity. According to Frazer, these centralized reins include "the power of the purse" (or financial accountability), "the power of segment manager destiny" (or administrative responsibility) and "the power of the audit" (or ultimate controllability).[13] Therefore, decentralization is a matter of degree. It not only varies from one company to another but even varies within the same company. The problem involved in firm structure is not so much centralization versus decentralization as it is the establishment of a framework which enables one to assure the effective operation of the other.

Decentralized Decision Autonomy

"Delegate responsibility--always with authority as well as with accountability. The delegation of responsibility is necessary to develop the abilities of man, but without authority, it creates frustration and destroys initiative. . ."[14] From this statement, it appears that

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[13]Chalmus F. Frazer, "Decentralization: An Antidote to Bigness," Personnel Administration, May-June, 1960, p. 15.

[14]Frederick C. Crawford, "Creating the Proper Climate," How to Increase Executive Effectiveness, ed. Edward C. Bursk (Massachusetts: Harvard University Press, 1953), pp. 12-13, cited by Raymond Villers, "Control and Freedom in a Decentralized Company," Harvard Business Review, 32 (March-April, 1954), 96.

the decentralization of authority, rendering sufficient decision autonomy, provides the key to successful versus unsuccessful segmental operations. But even the term "decentralization of authority" is vague and indicates only approximate degree. For example, in a 1962 survey conducted by Maughan covering 300 segmented firms, some evidence was found regarding the degree of diversity in decision-making responsibility. TABLE 4 (page 32) shows Maughan's findings with respect to the above survey. To some extent the variation shown in TABLE 4 probably reflects differences in the amount of diversification and geographical dispersion of segmental activities and also the confidence which top management has placed in segment management. The interesting fact that emerges from TABLE 4 is not so much the actual percentages shown but rather that, in all but one of the decision areas listed, no less than six different levels of management are said to possess decision-making authority. Realistically then, there tends to be a great deal of variation from company to company in the amount of authority delegated to segment management, and seldom is exclusive decision authority delegated to this level in the organization.

The above observation, assuming the information from TABLE 4 has reasonable validity in today's corporate operating environment, is important in that the responsibility vested in a given segment often does not coincide

TABLE 4

DECISIONS AND THE PYRAMID OF AUTHORITY

NATURE OF DECISION	PYRAMID OF DECISION AUTHORITY							
	BOARD	BOARD CHAIRMAN	COMPANY PRESIDENT	EXECUTIVE COMMITTEE	VICE PRESIDENT	SEGMENT MANAGER	DEPT. MANAGER	LOWER LEVELS
Investment/Capacity.	10%	1%	26%	11%	28%	24%		
New Production Process.	3%	1%	8%	5%	39%	35%		9%
New Product Introduction . . .			16%	9%	40%	32%	2%	1%
Inventory Change . .			13%	7%	38%	36%	1%	5%
Distribution Change.	1%		22%	6%	31%	23%	17%	
Advertising Budget .	4%		15%	10%	23%	25%	23%	
Packaging Redesign .			7%	4%	24%	33%	32%	

SOURCE: John Maughan, "Who Makes the Profit Decision?" Dun's Review and Modern Industry, September, 1962, cited by Solomons, op. cit., p. 18.

with the authority possessed by the segment manager. Furthermore, the questionnaire results associated with this study will bear out the premise that there exists some degree of top management confusion between operational segmentation and responsibility segmentation in the evaluation of a segment manager's performance. Stated differently, the evaluation of a segment's operating performance (or the evaluation of an activity) is not necessarily the same as the evaluation of the segment manager's performance (or the evaluation of a person in charge of an activity). The difference lies primarily in the boundaries around which the area of responsibility, in particular the aspect of controllability, is subsequently defined. The next section examines the establishment of these responsibility center parameters.

EVALUATIVE (RESPONSIBILITY) SEGMENTATION

In a full-scale decentralized organization, the segment manager would possess complete authority and responsibility for the performance of his segment. Prior to reaching this point, however, top management must be reasonably sure that the segment managers will always act, to the best of their ability, in the interest of the corporation as a whole. This means that the segment manager must "know" what actions are in the corporation's best interest, he must possess the "capability" (divisible

authority as well as divisible responsibility) to initiate such actions, and he must be sufficiently "motivated" to do so. Furthermore, if decentralized financial control is to be effective, the segment manager must be "evaluated" on actions he does initiate so that effective or ineffective performance can be ascertained. This latter phase, which is the focal point of this study, is extremely difficult because complex organizations generally have several goals which overlap and to some degree conflict: profits, growth, market share, social responsibility and eternal life, to name just a few. Of course, profits should be the corporation's dominant goal in view of its obligation to its stockholders and to a free enterprise system. However, these other objectives contribute in diffused ways to attainment of long-run profits, and thus, cannot be completely ignored in measuring performance.

The extent to which all of the above holds true, to a large degree, determines the parameter boundaries around which the various responsibility centers are defined. In essence, the purpose of defining centers of responsibility is to overcome areas of diffusion that would otherwise exist in the evaluative process. In this respect, there are basically three types of responsibility center designations, namely, cost centers, profit centers and investment centers. The problem associated with the marking off of responsibility center boundaries has two related

dimensions: (1) The segregation of service functions from profit centers, thereby defining cost centers, and (2) The definition of profit center versus investment center responsibility scope.

Segregation of Service from Profit Functions

Service centers comprise staff activities which normally cannot be satisfactorily measured in terms of profit performance, even though their services may contribute significantly to overall company profit. In general, service activities of this type should be considered under the umbrella of the cost center responsibility designation. The position assumed here is that it is not management's intention to make a profit by selling the services in question.

Cost centers. The cost center responsibility concept embraces a managerial responsibility for all operating costs or sales generated within a segment, but not an associated responsibility for resulting profits. In addition to the above-mentioned service areas, Dearden[15] outlines three other situations under which the establishment of profit center responsibility, even for nonservice areas, would be highly unlikely. Dearden's additional cost center considerations are as follows:

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[15]John Dearden, "Mirage of Profit Decentralization," Harvard Business Review, 40 (November-December, 1962), 150.

1. There exists in the corporation only one major activity: If this condition holds true, it is doubtful that top management will delegate adequate decision autonomy to a segment manager because the activity is too important to the welfare of the company, or

2. There exists in the company several major activities: In this case, due to the activity coordination necessary, it seem likely that one person, not several, will make the key decisions regarding these activities, or

3. There exists indivisible responsibility: If this conditions arises, then the control that a segment manager can exercise over his profit is considerably weakened. The existence of intracompany pricing problems and shared facilities is sometimes indicative of the fact that profit responsibility is indivisible or not clearly defined.

Definition of Scope: Profit Versus Investment Centers

Once the cost center responsibility segments have been clearly identified, remaining segments in the firm are classifiable either as profit centers or investment centers.

Profit centers. The profit center responsibility concept is applicable to any separately accountable organization unit that is responsible to top management for some financial measure of its profit performance. In this respect, the company's interest lies not in maximizing a particular type of revenue or in minimizing a particular type of cost in isolation, but rather in maximizing the

difference between all revenues and costs. Regarding profit center scope, Dean[16] recommends application of the following four economic tests in marking off profit center boundaries:

1. Operational independence should exist. In other-words, unless a segment has a large measure of independence, it will have inadequate scope to reach decisions on a profit-oriented basis,

2. The segment manager should have access to sources and markets. Independent access is essential in order to determine make-or-buy and make-or-sell decisions. In addition, the profit-center manager must be genuinely free to buy and sell in alternative markets both inside and outside the company,

3. Segmental costs and revenues must be divisible. Profit centers should be marked off so as to minimize the necessity for cost allocations, since these allocations are necessarily arbitrary. Also, a profit center must be able to split off its costs and find an economically realistic price for its end products; otherwise measurement of its profit performance is impossible, and

4. Managerial intent must be consistent. This condition implies that only if the basic goal of the segment is, in fact, profits, should the operation of the

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[16]Joel Dean, "Decentralization and Intracompany Pricing," Harvard Business Review, 33 (July-August, 1955), 67.

segment be treated responsibility-wise as a profit center.

Investment centers. In order to employ the investment center concept, a company must be able to decentralize its profit responsibility. In this respect, a profit center converts into an investment center when, in addition to satisfying the above-outlined profit center criteria, the segments are also each accountable to top management for investment resource utilization in this profit earning process. The implication, of course, is that each segment must be able to exercise considerable control over the size and composition of its investment base as well as control over its revenues and expenses. In addition, performance measurements such as return on investment and residual income can only be applied, according to the above definition, in the evaluation of investment center performance.

With the above statement in mind, the corporations participating in the questionnaire survey conducted in this study were asked in what way they defined the boundaries of their internal segments for responsibility purposes. TABLES 5 and 6 (page 39) summarize the response received to this inquiry. As shown in these tables, an overwhelming majority of large industrial organizations utilize the investment center responsibility concept. The fact that so many businesses have, in recent years, focused increasing attention on the efficient utilization of

TABLE 5

INTRAFIRM SEGMENTAL RESPONSIBILITY DESIGNATIONS
ANALYSIS BY INDUSTRY GROUPING

INDUSTRY GROUPING	RESPONSIBILITY CENTERS		
	NO PROFIT/ INVESTMENT CENTERS	PROFIT CENTERS	INVESTMENT CENTERS
Appliances/Electronics. . .	2	4	11
Chemicals/Pharmaceuticals .		10	27
Communications.		2	4
Computers/Office Equipment.		2	6
Food/Beverages/Tobacco. . .	2	15	23
Industrial Equipment. . . .		7	22
Leisure/Sporting Goods. . .		2	4
Paper/Paper Products. . . .		4	15
Petro. Products/Refining. .	1	6	16
Scientific/Aerospace. . . .		4	4
Textiles/Apparel.		4	18
Vehicles/Vehicle Parts. . .		8	21
Wood Products/Construction.		4	15
Metals/Other Industries . .	2	8	29
Total Number of Firms . . .	7	80	215
Percentage Rates*	2%	27%	71%

TABLE 6

INTRAFIRM SEGMENTAL RESPONSIBILITY DESIGNATIONS
ANALYSIS BY FIRM SIZE

FIRM SIZE	RESPONSIBILITY CENTERS		
AT LEAST - LESS THAN	NO PROFIT/ INVESTMENT CENTERS	PROFIT CENTERS	INVESTMENT CENTERS
No Minimum - $200 Million		9	14
$200 Million - $350 Million	2	20	46
$350 Million - $500 Million	2	13	36
$500 Million - $800 Million	2	10	37
$800 Million - $1 Billion .		7	7
$1 Billion - $2 Billion .	1	6	35
$2 Billion - No Maximum .		15	40
Total Number of Firms . . .	7	80	215
Percentage Rates*	2%	27%	71%

SOURCE: Corporations responding to questionnaire.

*302 firms equals 100% for TABLES 5 and 6.

segmental assets is to be applauded. In terms of concept evolution, the introduction of the profit center concept, popularized during the 1950's, was a significant advance over previous exclusive use of segmental cost centers. Likewise, the increasing use of the investment center concept represents an even greater improvement over the profit center concept. Encouraging a manager to focus his attention not only on profits, but also on the investment required to produce that profit, represents a welcome refinement to the theory of decentralization. Of course, not all corporations either desire or have operational use for the investment center concept. TABLE 7 (page 41) outlines the reasons provided by the 87 firms who had indicated in TABLES 5 and 6 that they did not utilize the investment center responsibility concept. As shown in TABLE 7, the vast majority of firms indicated highly valid and understandable reasons for not having investment centers.

SUMMARY

From the foregoing, it would appear that the modern, integrated, multiple-product, profit-oriented firm functions most successfully if it is comprised of divisible operating units, each possessing the following characteristics:

1. Operational Independence: Operational independence is necessary in order to make separate profit and resource

TABLE 7

REPORTED REASONS FOR NOT HAVING INVESTMENT CENTERS

REASONS CITED	FREQUENCY		TOTAL FIRMS 100%
	TOTAL FIRMS	PERCENTAGE OF TOTAL	
Desire for centralized control over major decisions (lack of segmental decision autonomy). .	28	32%	
Segmental facilities are highly interrelated and complementary.	24	28%	
Investment center concept is not applicable to the nature of the firm's operational philosophy .	10	11%	87
Firm is currently in the process of converting its responsibility segments from profit to investment centers.	10	11%	
Other reasons cited	3	4%	
Total Response to Inquiry	75*	86%*	87**

SOURCE: Corporations responding to questionnaire.

*Response percentage is less than 100% because 12 out of 87 firms not having investment centers did not give an answer to this inquiry.

**Information derived from TABLES 5 and 6.

responsibility a reality; however, if self-contained to the extreme, the very idea of a segment as being an integral part of a greater whole would be destroyed,

2. Intersegmental Cooperation: Having called above for a substantial degree of independence, what is being advocated also is a certain degree of cooperation or interdependence. In otherwords, if a segment, wherever possible, contributes to the success of other segments as well as to itself, this segment will, by implication, also contribute to the success of the composite corporate whole. This contribution may assume numerous forms. For example, two or more segments may produce complementary products, the sale of one segment's products helping to create demand for another's,

3. A further quality for success is that relations between segments should be so organized that no single segment, by seeking its own profit, can reduce the profit for the enterprise as a whole. Proper boundary definition can help to minimize this form of suboptimal activity, and

4. Adequate decision authority should be vested in the segment manager. This delegated authority should leave to the segment manager's discretion not only "how" the operations of his segment should be carried out, but also, within limits, "what" the nature of those operations should be.

In summary, if the above segmental qualities prevail

in any given corporation, then each segment in seeking to maximize its own potential will also maximize the potential of the entire entity.

Utilizing the investment center responsibility boundaries, as outlined within this chapter, a discussion of investment center performance evaluative tools will now take place. In this respect, the measurement tools commonly used in the evaluation of investment center managerial performance are examined contextually in the next chapter.

Chapter 3

MEASUREMENT TOOLS USED IN THE EVALUATION OF INVESTMENT CENTER MANAGERIAL PERFORMANCE

In the evaluation of internal managerial segments, two objectives exist: To guide the segment manager whose performance effectiveness is assessed, and to assist top management in its task of appraising segmental performance results.

OVERVIEW OF THE INTERNAL MEASUREMENT SYSTEM

In view of the above objectives, the measurement system used in this evaluation should assist and motivate segment management in the formulation of business decisions that will maximize the potential of the entire organization. In addition, this same measurement system should provide top management with a reliable and fair index of segmental management progress toward the achievement of corporate goals. Admittedly, full accomplishment of the above objectives tends to be more idealistic than realistic. Much of this nonaccomplishment difficulty has to do with a lack of internal (as opposed to external) measurement refinement as well as a genuine confusion of the internal and external measurement systems. These problem areas tend to

be specifically reflected in the following key areas of evaluation.

Internal Versus External Evaluation

With respect to internal versus external measurement systems, much of the confusion lies in the failure to recognize the necessity of different accounting data for different evaluative needs. More specifically, a distinction should be drawn between published financial data and financial data produced and used solely within the confines of a particular company. Numerous examples can be cited where this distinction simply has not been made. For example, accounting data for purposes of public reporting must adhere to specifications governed by generally accepted accounting principles, one of which involves procedural consistency. For purposes of internal measurement involving firm segments, procedural consistency as well as segmental data uniformity need not exist. This sentiment was probably best expressed by John Hartmann in his 1968 speech to the Tulane Symposium when he reported:

> "Internal accounting principles are those which work for a particular company. There is no need for them to have been accepted by anyone else, nor need they be consistent either companywide or from period to period."[17]

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[17]John J. Hartmann, "A View from Management," Public Reporting by Conglomerates (New Jersey: Prentice-Hall, Inc., 1968), p. 67, cited by R. K. Mautz, Financial Reporting by Diversified Companies (New York: Financial Executives Research Foundation, 1968), p. 23.

The foregoing is not intended to imply that data for internal purposes should not meet rigorous standards; rather, the primary point to be made is that management, using its own internal standards, should be able to generate relevant data for each type of situation or evaluative need that arises. In subsequent chapters, further evidence will be provided relevant to the premise that in today's technologically sophisticated and complex corporate society, there still exists a strong reliance on generally accepted accounting principles for internally-oriented evaluations. This, in itself, is not too surprising when one considers the fact that conventional accounting systems have tended to grow in response to external forces. Accordingly, in the words of Fair:

> "Very few people in business have had the opportunity to reflect on the way in which the accounting model developed, particularly on how an instrument well adapted to detect fraud and measure tax liability has gradually been used as a general information source. Having become accustomed to information presented in this form, business people have adapted their concepts and patterns of thought and communication to it rather than adapting the information to the job or person. . ."[18]

Firm Versus Segment Evaluation

When a firm is organized around investment centers,

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[18]William R. Fair, "The Next Step in Management Controls," Management Control Systems, ed. Alan J. Rowe (New York: John Wiley and Sons, Inc., 1960), pp. 229-230, cited by Charles T. Horngren, "Choosing Alternative Accounting Practices for Reporting to Management," N.A.A. Bulletin, 44 (September, 1962), 3.

it is generally desirable to have the sum of all the individual segment resources and earnings equal to that determined for the company as a whole--at least this is the sentiment implied by generally accepted accounting principles. The justification for this equality is that it is easier to make intersegment performance comparisons and also avoids the problem of establishing one standard rate of return for the company as a whole and another return rate for each of its component parts. In dispute of these arguments--since management is concerned with segmental evaluation in itself--it is immaterial that the basis on which this evaluation is formed differs from either other segments or the basis used in external corporate reporting. In addition, the synergistic effect of consolidated efforts on the corporate level should cause the combined results of the whole to be greater than the sum of its separate parts. Therefore, the sum of segmental activity need not and most likely should not equal the sum of the whole. What is of significance is that segment managers realize that any actions taken on their part should contribute to, not detract from, obtainment of overall corporate goals.

Segment Manager Versus Segment Evaluation

Much of the literature written on the subject of decentralized performance evaluation fails to distinguish between the segment and the segment manager in performance measurement. The end result of failing to draw this

distinction through boundary line definition is possible suboptimal behavior. This potential suboptimization problem will be discussed in added detail in succeeding chapters. The focus of this later discussion will center on proper versus improper managerial motivation in providing a cause-and-effect relationship.

The above section illustrates how imperfect and unrefined the internal measurement framework actually is and isolates some specific problems that exist. In addition, the tendency for segmental interchange with other segments coupled with the support which one segment lends to another and the company's plans for one segment versus another, all combine to make the evaluation of individual segments and their management most difficult. The next section discusses the measurement tools that are used in attempting to resolve this evaluation problem.

INVESTMENT CENTER PERFORMANCE EVALUATION TOOLS

In measuring the effectiveness of an investment center manager, there are two basic philosophical approaches: Measurement and evaluation of profit and investment can be performed as separate evaluations, or profit and investment can be combined into a single measure of managerial effectiveness. Those corporations that have resorted to this latter measurement philosophy have attempted to accomplish their objective through either the calculation of a ratio

referred to as return on investment (ROI) or through a related measure known as residual income. In applying either measure, the basic theory is the same; this is, if each investment center manager earns a satisfactory return on the investment he employs, then the company as a whole should also earn a satisfactory return.

The extent to which each of the above evaluative tools is employed in the assessment of investment center managerial performance is provided by TABLE 8 (page 50) and TABLE 9 (page 51). These tables show that a substantial number of large U. S. industrial firms--97 percent--utilize return on investment in evaluating managerial segments. Although the related statistics for the use of the residual income concept--14 percent--are not nearly so impressive, the reader must be mindful of the fact that the residual income approach was virtually unheard of just ten years ago. Additionally, it should be noted that only 2 percent of the firms which employ investment center responsibility do not use either form of evaluation, while 13 percent of these firms use both return on investment and residual income measures.

Due to the greater current importance of ROI in managerial performance evaluation, as indicated by the above two tables, the sensitivity analysis included in this study emphasizes the sensitivity of ROI only in its test phases. A contextual examination of each evaluative

TABLE 8

INVESTMENT CENTER PERFORMANCE EVALUATIVE TOOLS
ANALYSIS BY INDUSTRY GROUPING

INDUSTRY GROUPING	*TOTAL INVESTMENT CENTERS WITHIN THE FIRM	INVESTMENT CENTER EVALUATIVE TOOLS					
		DOES NOT USE ROI/ RESIDUAL INCOME	USES ROI	USES RESIDUAL INCOME	USES BOTH TOOLS	ROI TOTAL FIRMS	RESIDUAL INCOME TOTAL FIRMS
Appliances/Electronics. . .	11		10		1	11	1
Chemicals/Pharmaceuticals .	27		23		4	27	4
Communications.	4		3		1	4	1
Computers/Office Equipment.	6		5		1	6	1
Food/Beverages/Tobacco. . .	23	1	17		5	22	5
Industrial Equipment. . . .	22		19	2	1	20	3
Leisure/Sporting Goods. . .	4		1		3	4	3
Paper/Paper Products. . . .	15		14		1	15	1
Petroleum Products/Refining	16	1	15			15	
Scientific/Aerospace. . . .	4		4			4	
Textiles/Apparel.	18		15		3	18	3
Vehicles/Vehicle Parts. . .	21	1	19		1	20	1
Wood Products/Construction.	15		12		3	15	3
Metals/Other Industries . .	29	1	23		5	28	5
Total Number of Firms . . .	215	4	180	2	29	209	31
Percentage Rates.	100%	2%	84%	1%	13%	97%	14%

SOURCE: Corporations responding to questionnaire.

*Information derived from TABLE 5.

TABLE 9

INVESTMENT CENTER PERFORMANCE EVALUATIVE TOOLS
ANALYSIS BY FIRM SIZE

FIRM SIZE AT LEAST - LESS THAN	*TOTAL INVESTMENT CENTERS WITHIN THE FIRM	INVESTMENT CENTER EVALUATIVE TOOLS					
		DOES NOT USE ROI/ RESIDUAL INCOME	USES ROI	USES RESIDUAL INCOME	USES BOTH TOOLS	ROI TOTAL FIRMS	RESIDUAL INCOME TOTAL FIRMS
No Minimum - $200 Million	14	1	10		3	13	3
$200 Million - $350 Million	46		41	1	4	45	5
$350 Million - $500 Million	36		26		10	36	10
$500 Million - $800 Million	37	1	31		5	36	5
$800 Million - $1 Billion .	7		7			7	
$1 Billion - $2 Billion .	35	1	30		4	34	4
$2 Billion - No Maximum .	40	1	35	1	3	38	4
Total Number of Firms . . .	215	4	180	2	29	209	31
Percentage Rates.	100%	2%	84%	1%	13%	97%	14%

SOURCE: Corporations responding to questionnaire.

*Information derived from TABLE 6.

tool follows.

RETURN ON INVESTMENT

As shown in the previous section, nearly every major decentralized industrial firm in the United States today utilizes some adaptation of return on investment in the measurement of investment center managerial performance. In this respect, there are basically two major forms that ROI can assume. Each of these forms is designed to meet a different evaluative need. These adaptations are:[19]

1. Cash return, which is used in the evaluation of economic performance, and consists of the ratio of cash income to cash invested in the segment, and

2. Operating return, which is used in the evaluation of segmental operating performance, and consists of the ratio of operating income to operating investment.

This study concerns itself only with the latter form of return on investment. Thus, the important thing to keep in mind is that the ROI measure involves operating efficiency, not economic value and as such, the investment base should consist of the operating, not the cash, value of the assets employed. In an overall sense, FIGURE 2 (page 53) presents a conceptual scheme in which the relationship of factors affecting the determination of

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[19]Edward A. Ravenscroft, "Return on Investment: Fit the Method to Your Need," Harvard Business Review, 38 (March-April, 1960), 97.

operational return on investment is illustrated.

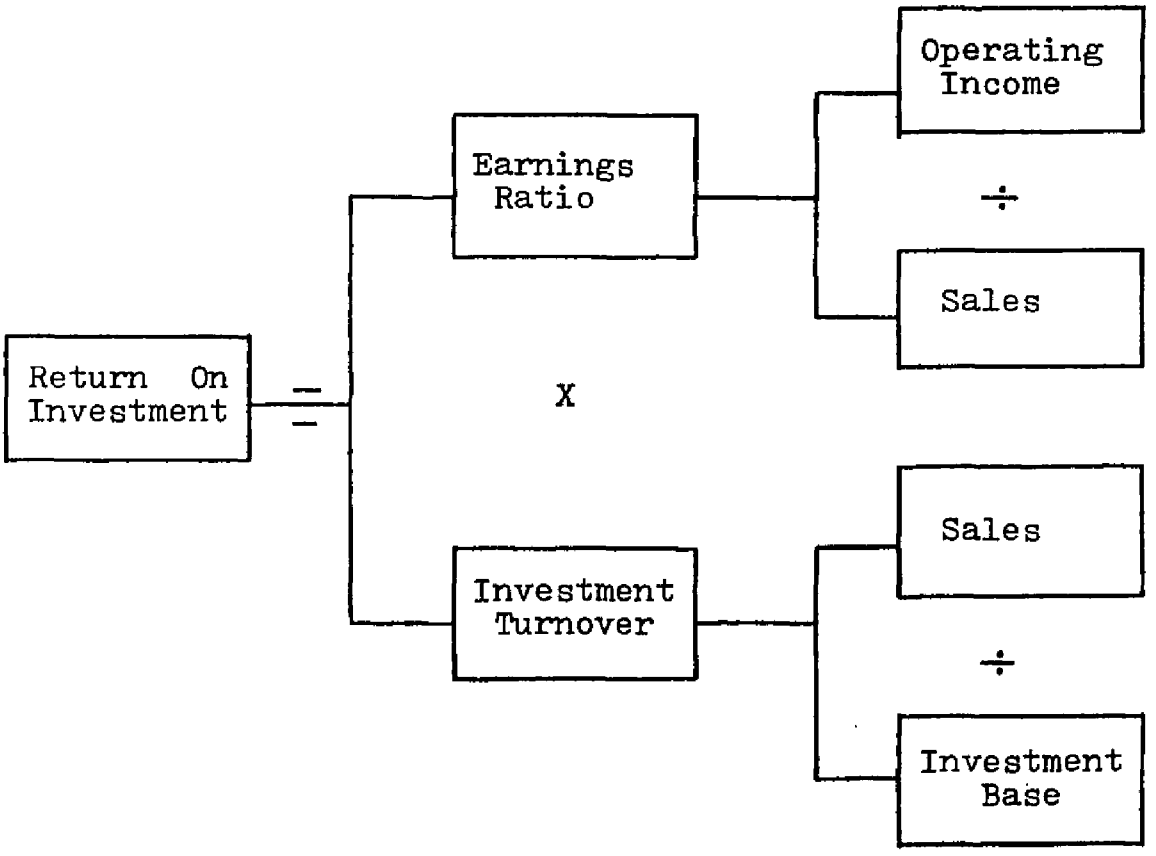

FIGURE 2
RELATIONSHIP OF FACTORS AFFECTING RETURN ON INVESTMENT

As can be seen from FIGURE 2, ROI as an operating performance measure is a tool which brings together in one ratio most of the diverse factors relative to the earning power exhibited by a segment manager. It is a measure of "efficiency" to the extent that this formula attempts to relate segmental profit (output) to the investment employed in earning this profit (input). It is obvious that the return could be calculated simply by dividing operating income by the investment base. To do so, however, is to

obscure critical factors which affect the overall return. The earnings ratio component shows the cost-price relationship and indicates the spread between revenues and expenses during the period in question. The investment turnover or velocity component provides an indication of management's efficiency in using the assets at its disposal to generate sales volume, and in essence, shows the relative efficiency with which a segment utilizes these resources in earning its profits. It should be noted that neither the earnings ratio nor the turnover ratio alone provides an adequate measure of operating efficiency, due to the fact that the former ignores the utilization of assets while the latter ignores profitability on sales. Therefore, both ratio results must be combined in order to measure efficient segmental earning power.

Return on investment is a measure of "effectiveness" to the extent that the final return results are compared with preestablished objective segment goals or target rates. The extent to which segmental target rates are employed in the firms surveyed, and the criteria used to determine these target rates is shown in TABLE 10 (page 55). This table indicates that 82 percent of the firms using ROI establish ROI target rates. Equally important is the fact that 83 percent of the firms that establish target rates set different goal objectives for different investment center managers. Thus, the uniqueness of one investment

TABLE 10

ANALYSIS OF RETURN ON INVESTMENT EVALUATIVE TOOL:
ROI TARGET RATES

QUESTIONNAIRE INQUIRY AND TARGET RATE RESPONSE	RETURN ON INVESTMENT TARGET RATES				TOTAL FIRMS 100%
	NO		YES		
	TOTAL FIRMS	PERCENTAGE OF TOTAL	TOTAL FIRMS	PERCENTAGE OF TOTAL	
Are return on investment target rates established?	37	18%	172	82%	209
If YES, are the established ROI target rates the same for all investment center segments?. . .	143	83%	29	17%	172
ROI Target Rate Basis:					
Corporate rate of return			46	27%	
Corporate cost of capital.			53	31%	
Industrial conditions.			71	41%	172
Future or budgeted profit.			77	45%	
Past investment center performance			62	36%	
Total Response to Inquiry.			309*	180%*	172

SOURCE: Corporations responding to questionnaire.

*Response percentage exceeds 100% because 75 out of 172 firms gave multiple answers to this inquiry.

center versus another (i.e., size, age, composition, location, and operating environment) is at least partially acknowledged. Other differences such as growth rates and varying degrees of risk are more difficult to ascertain and, therefore, are often not acknowledged in the measurement at all. Thus, all forces affecting segmental activity are not perceived with equal clarity, nor do these forces, even when recognized, always work in the same direction or pattern. As such, even with the use of differential target rate objectives, ROI as a measure of managerial effectiveness is only realistically effective if the factors contributing to investment center uniqueness are recognized, understood, and provided for. Lastly, it should be noted that the vast majority of firms use multiple criteria in establishing segment management target goals. In an overall sense, and in line with the Du Pont system (as ROI is frequently named), it appears that segmental effectiveness is primarily judged by the segment manager's ability to satisfy a projected ROI goal, not by his ability to live within set budget constraints.[20] For example, in the short run, a segment manager may influence the earnings ratio or investment turnover in a number of ways: The earnings ratio can be influenced by reducing costs or by increasing sales volume (and therefore profits) through a

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[20]John Dearden, "Case Against ROI Control," Harvard Business Review, 47 (May-June, 1969), 125.

modification of the sales price and marketing strategy within the constraints imposed by competition. The turnover ratio can be influenced by working the capital employed more intensely, by converting part of the plant to other product lines (thereby spreading the investment base), or by simply eliminating part of the investment base itself.[21] In this latter case, if a segment manager's return goal is 5 percent after taxes, a reduction of one dollar in the investment base has the same impact on performance as a 10-cent savings in cost or a 10-cent increase in profits from added revenues (assuming a 50 percent tax bracket). Naturally, some of the decision actions stated above have reciprocal effects on both elements of the ROI equation as well as long-term implications for both the segment and the company as a whole. Therefore, prior to implementing any changes, it is important that full appraisal of each factor on a short and long-term basis be initiated.

As a measure of investment center managerial performance, return on investment is said to possess the following strengths:[22]

1. ROI is a comprehensive measure, influenced by

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[21]Ibid., p. 126; see also Dudley Stewart, "The Search for a Business Survival Coefficient: The Role of ROI," The Journal of Accountancy, 123 (April, 1967), 62 and Harvey O. Edson, "Return on Investment: Analysis by Synthesis," The Ohio Certified Public Accountant, Spring, 1969, p. 76.

[22]Robert N. Anthony, John Dearden, and Richard F. Vancil, Management Control Systems, (rev. ed.; Illinois: Richard D. Irwin, Inc., 1972), p. 337.

everything that has occurred which affects the financial status of a segment. Further, ROI is a means of making the goals of the segment manager congruent with those of the overall corporation; that is, if the segment manager maximizes his return goal, it should automatically follow that the total company also maximizes its return.

2. ROI provides an incentive to use existing assets to their fullest and to acquire additional resources only when they are likely to increase the return ratio. In otherwords, ROI measures how well the segment manager uses his property and resources to generate segment profits. Thus, by including new investments in the performance base, the investment center ROI will be automatically affected in an adverse way when actual profits fail to meet those levels originally projected.

3. ROI is a common denominator. As such, resulting segment manager performance can, if desired, be compared with other performance ratings within the company. Also, the significance of ROI is easily understood. For example, if a segment manager earns 3 percent after taxes, the firm as a whole could realize more through an external investment in bonds. Conversely, a segment manager earning 30 percent after taxes is earning a greater return than could be realized on almost any type of alternative use of funds.

In short, ROI is suppose to result in each segment manager optimizing his return which should, in turn, result

in an optimum total company return. Since a manager is evaluated on his ability to optimize ROI, he will obviously be motivated to do so. The extent to which the above ROI advantages still exist due to this motivation tendency, however, is questionable in view of ROI's following weaknesses:

1. The primary weakness associated with the return on investment measure is that it focuses attention on the maximization of a ratio rather than on an improvement in absolute profits.[23] As shown in FIGURE 3 improvement in a segment's ROI can be inversely related to the associated improvement in total dollar profits. In otherwords, the segment possessing the highest ROI is not necessarily the most profitable segment within a company.

	Investment Centers		Total
	Segment A	Segment B	Company
Investment Base.	$1,000	$5,000	$6,000
Profit Earned.	200	750	950
Return on Investment . . .	20%	15%	16%

FIGURE 3

CONFLICT BETWEEN ROI AND PROFIT PERFORMANCE

In the above illustration the conflict arises because despite the fact that Segment A's ROI exceeds that for Segment B, Segment A's profit performance is lower.

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[23]Harold Bierman, Jr., "Problems in Computation and Use of ROI," N.A.A. Bulletin, 39 (December, 1957), 81.

Thus, in this case, return on investment is being maximized at the potential sacrifice of total profit optimization. In addition to the conflict situation cited above, emphasis on ratio as opposed to dollar profit improvement also tends to retard incentive for growth and expansion. In otherwords, one of the easiest ways to increase ROI over the short range is to contain operations to their present capacities. Lastly, the situation in which the maximization of ROI and the maximization of operating profits holds an inverse relationship generally occurs when investment center management has discretionary control over a significant portion of their investment base. Conversely, if segment assets are committed or relatively fixed in nature over the short run, the maximization of of the ROI ratio would simultaneously also result in the maximization of absolute dollar profits.

2. Another weakness in ROI, closely related to the above, is that a segment earning a higher ROI than the corporation as a whole is discouraged from entering an investment situation where the expected ROI falls in between. For example, in the situation illustrated in FIGURE 3, Segment A's management would be highly reluctant to accept any proposal yielding an ROI of less than 20 percent, yet for the firm as a whole, any proposal that yields a return greater than 16 percent should be undertaken within the segments. In the situation described

inconsistency or lack of congruency exists between segmental and firm objectives. Corporate suboptimization may result as a consequence of this conflict, because motivation and evaluation are two sides of the same coin. In essence, a segment manager will be motivated to optimize the factors on which he is to be evaluated. To illustrate suboptimal conflict, consider the following true situation:

> A segment manager scrapped some equipment that he was not presently using in order to reduce the effect of this resource in his investment base. Later, when this equipment was needed in operations, the segment manager simply purchased new equipment.[24]

Thus, the above situation shows that in an attempt to improve the short-run measure of ROI, a segment manager may be motivated to initiate decision actions contrary to the company's long-run interests.

3. The last major weakness in ROI stems from the fact that ROI simplifies a very complex decision process. In otherwords, ROI is too simple a rule on which to base the appropriate tradeoff between profits and investment. Additionally, with ROI, the same return rate is applicable to all assets within a given segment. This creates a problem because different types of assets might realistically be expected to earn different rates of return. Furthermore, although the tradeoff between investment and profit is a constant factor within any given segment, among

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[24]Bruce D. Henderson and John Dearden, "New System for Divisional Control," Harvard Business Review, 44 (September-October, 1966), 150.

different segments this tradeoff will differ if their profit goals differ. Consequently, identical assets located in different segments could be subject to varying return rates.[25]

In summary, in order to manage integrated assets successfully, a firm must achieve a balance of resources among its internal segments, a balance that maximizes short-run profits but does not sacrifice their long-term stability. From the foregoing, it would seem that the ROI measure, in its present form, fails to accomplish this goal.

RESIDUAL INCOME

Perhaps the most important adaptation of the ROI concept has been the residual income approach, developed by the General Electric Company in the 1950's.[26] Using this method of evaluation, investment center managerial performance is measured as segmental actual profits minus a prescribed percentage charge for the resources the segment manager employs in his operations. Conceptually, the relationship of factors affecting the determination of residual income is illustrated in FIGURE 4 (page 63).

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[25] Anthony, Dearden, and Vancil, op. cit., p. 346.

[26] See the "General Electric Company" case in ibid.

Although residual income was developed in the 1950's, this concept was not widely used as a performance measure until about 10 years ago.

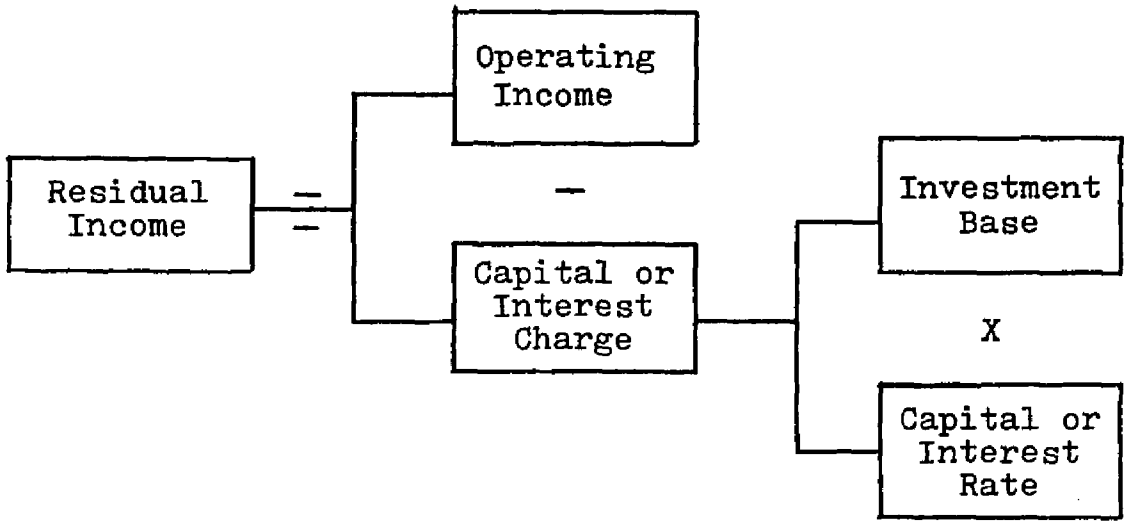

FIGURE 4
RELATIONSHIP OF FACTORS AFFECTING RESIDUAL INCOME

Unlike ROI, which is a relative measure, residual income is a measure in absolute dollars. This emphasis toward a number instead of a ratio provides a quality that aids in overcoming some of the ROI limitations previously described. As an example, consider the situation outlined in FIGURE 3 (page 59) and inquire: Which segment manager has been the most successful in his operating performance? In answering this question, a criterion must be established. If absolute profit is the test, the answer is Segment B, however, if rate of return is the test, then Segment A is the answer. In actuality, the resolution as to who has been the most successful manager is not determinable without consideration of the required minimum earnings rate that justifies the use of resource facilities in each segment.

Assuming that the firm's weighted average cost of capital represents this minimum earnings rate, FIGURE 5 restructures the information previously shown in FIGURE 3 in order to help resolve the management success evaluation conflict. The results shown in FIGURE 5 are based on the use of residual income (as opposed to FIGURE 3's ROI) as the success criterion and cost of capital as the charging rate.

	Investment Centers		Total
	Segment A	Segment B	Company
Investment Base.	$1,000	$5,000	$6,000
Profit Earned.	200	750	950
Residual Income (Loss) Assuming a Cost of Capital Rate of:			
12%.	80	150	230
15%.	50	0	50
17%.	30	(100)	(70)

FIGURE 5

RESOLUTION OF CONFLICT BETWEEN ROI AND PROFIT RESULTS THROUGH RESIDUAL INCOME EVALUATION

FIGURE 5 illustrates that while the venture which gives the highest rate of return can be pointed to unequivocally, there is no simple answer to the question of which of these investment center managers is more successful in terms of residual income performance.[27] While Segment B's management is more successful at lower charging rates, Segment A's management is more successful at higher charging rates. A mere comparison of rates of return (as illustrated in

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[27]Solomons, op. cit., pp. 61-63.

FIGURE 3) obscures this fact.

The primary reason, however, for prefering a segment manager to maximize residual income rather than ROI is that the latter measure may cause the manager to be unwilling to expand investment if it will lower his segment's average return rate, even though the incremental dollar return from doing so is in excess of cost. Assuming discretionary authority over a segment's investment base, the segment manager undoubtedly will have an upper ceiling to his power to expend funds but no lower limit, as long as the dollar return exceeds the cost which justifies the use of the funds in question. If, however, funds are fixed instead of discretionary, it would be just as satisfactory to have the segment manager maximize ROI, as this would be equivalent to his maximizing total absolute dollars as well.[28]

Before the measure of residual income can be determined, two major questions must be answered:

1. How is the investment base defined and what is its composition?

2. What basis is used for establishing the interest or capital investment charging rate?

The first question would have to be answered even if ROI rather than residual income was being used as the evaluation criterion. As such, discussion of investment

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[28]Ibid., pp. 63-64.

base scope and composition will be deferred until Chapter 5. The second question relative to charging rates does not arise with the return on investment calculation but is a key factor in the measurement of residualincome. In this respect, TABLE 11 (page 67) shows the results of pertinent questions regarding residual income that were posed to the corporations responding to the survey used in this study. This table shows that the vast majority of firms using residual income establish their charging rates using as a guide either the firm's cost of debt--39 percent--or the firm's weighted average cost of capital--33 percent. This latter basis seems to be particularly appropriate since it would encourage an investment center manager to accept all marginal reinvestment or new proposals favorable to the company as a whole. At the same time, any inefficient or unprofitable use of corporate resources would be penalized. In addition, a firm charging rate basis (as opposed to a segment rate basis) is used probably because diversified corporations will seek to reduce the risks associated with its individual investment center segments through a risk offsetting process. For this reason, segmental risk is not assessed by viewing each segment in isolation. The response to the second question in TABLE 11 tends to bear out this contention, in that only 10 percent of the responding firms vary their charging rate from one investment center to another. Regardless of

TABLE 11

ANALYSIS OF RESIDUAL INCOME EVALUATIVE TOOL:
CAPITAL (INTEREST) CHARGE RATE INDEX

QUESTIONNAIRE INQUIRY AND CHARGE RATE INDEX RESPONSE	RESIDUAL INCOME CHARGE RATE INDEX				TOTAL FIRMS 100%
	NO		YES		
	TOTAL FIRMS	PERCENTAGE OF TOTAL	TOTAL FIRMS	PERCENTAGE OF TOTAL	
Are different capital (interest) charge rates applied to different classes of assets?. .	29	94%	2	6%	31
Are different capital (interest) charge rates established for each investment center segment?	28	90%	3	10%	
Criteria for Charge Rate:					
Segment's overall earnings rate			2	6%	31
Firm's overall earnings rate.			1	2%	
Target Earnings rate.			4	14%	
Firm's weighted average cost of capital			10	33%	
Firm's cost of debt			12	39%	
Other criteria.			2	6%	
Total Response to Inquiry			31	100%	31

SOURCE: Corporations responding to questionnaire.

the charging criteria used, however, the rate established should be kept low in order to avoid some of the same pitfalls previously attributed to ROI. One further observation needs to be made relative to TABLE 11: It was surprising to note that 94 percent of the responding firms apply the same charging rate to different classes of assets within a segment. It would appear that these firms are implying that all assets should be required to earn the same percentage return, a weakness that was discussed earlier in the analysis of ROI. It is quite possible, however, that these companies do differentiate between asset characteristics through the establishment of differential dollar residual income target objectives, but the extent to which this compensating factor exists is unknown because a question of this type was not included in the survey, and the literature on the residual income topic area is extremely vague.

From the foregoing discussion, it is clear that some of the weaknesses previously attributed to the use of ROI are resolvable or at least minimized through the use of residual income. The strengths most commonly associated with the use of residual income are as follows:[29]

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[29]John J. Mauriel and Robert N. Anthony, "Misevaluation of Investment Center Performance," Harvard Business Review, 44 (March-April, 1966), 104; see also Eliot Terborgh, "Evaluation of Investment Center Performance," Management Accounting, 50 (March, 1969), 50 and Dearden, "Case Against ROI Control," op. cit., p. 130.

1. The primary advantage of residual income is that this measure focuses attention on a dollar income figure rather than on a ratio. Since the segment manager is now looking at the absolute size of his income, it would always be to his advantage to enter a venture if he could expect to earn a dollar return sufficient to more than offset the capital charge that would be levied. Unlike with the use of ROI, the decision criteria stated above would relate to both high and low earning investment centers, thereby avoiding the problem that may occur when a segment has a very high ROI. Also, emphasis on a dollar figure makes use of the residual income tool easier to understand because the segment manager is asked to maximize a number rather than a ratio. Furthermore, this absolute nature possessed by residual income facilitates budgeting, in that a target goal for residual income dollars can be included as an integral part of the segment's profit budget program.

2. An additional strength associated with residual income is that this tool renders a great deal of flexibility in that the rate assessed can be varied from segment to segment or according to the type of assets composing the investment base in order to emphasize certain corporate objectives. For example, the short-term marginal borrowing rate could be used as the charging factor for inventories while the long-term cost of capital rate could be used when determining the charging factor for fixed assets. Furthermore, different rates can also be used for different types

of fixed assets in order to reflect varying degrees of associated risk. Therefore, unlike in the ROI measure, identical assets located in different investment centers can all be charged with the same percentage rate in order to maintain discretionary decision consistency among the segment managers. Of course, in TABLE 11's survey results, it was revealed that no more than 10 percent of the firms using residual income vary the investment base charging rate in any of the above-mentioned ways. In view of this fact, it would appear that few corporations realize the flexibility afforded by the residual income measure. A more important consideration is the consequence that few corporations end up having a performance measurement system that is consistent with the decision rules that affect the planning process in the acqusition, utilization, and disposal of asset resources.

Despite the above somewhat impressive advantages, the residual income measure still possesses the following weaknesses:

1. Once residual income is determined for an investment center manager, the performance results cannot be used for any type of intersegmental comparison, since absolute dollar amounts are not subject to meaningful direct comparisons. In addition, when a firm utilizes both ROI and residual income and the performance results conflict (as previously illustrated in FIGURES 3 and 5 on

pages 59 and 64), which tool is considered as the more reliable performance measure? Due to the comparative ability of the ROI ratio, very often the residual income results are considered as subordinated to ROI when conflict situations arise. In the present questionnaire study, 13 percent of the firms responding to the survey use a combination of both tools in their evaluation efforts, so the above observation assumes some degree of importance.

2. In the case of residual income, as with ROI, the problem of identifying investment base scope and composition remains a formidable task. Obviously, then, the problem of potential suboptimization has not been completely resolved through the use of the residual income measure.

OTHER FORMS OF INVESTMENT CENTER MANAGERIAL EVALUATION

Instead of attempting to combine profitability and investment into a single measure of effectiveness, some firms resort to a separate analysis of these two factors through a combination of actual versus budget comparisons and post-completion audits. Other firms utilize different tools entirely in evaluating investment center management. Most firms, however, use ROI or residual income but supplement these measurement results with additional forms of evaluation. The extent to which other forms of evaluation are used, either in replacement of or in addition to ROI and residual income, is summarized in TABLE 12 (page 72).

TABLE 12

OTHER TOOLS USED IN REPLACEMENT OF OR IN ADDITION TO ROI AND RESIDUAL INCOME IN THE EVALUATION OF INVESTMENT CENTER MANAGEMENT

QUESTIONNAIRE INQUIRY AND NATURE OF TOOL RESPONSE	OTHER TOOLS USED				TOTAL FIRMS 100%
	NO		YES		
	TOTAL FIRMS	PERCENTAGE OF TOTAL	TOTAL FIRMS	PERCENTAGE OF TOTAL	
Are performance measures other than return on investment and residual income used to evaluate segmental management?	106	49%	109	51%	215
Nature of Other Tools Used:					
Current compared with prior period's performance. .			15	13%	
Profit margin and growth of same.			25	23%	
Return on Sales			37	34%	
Actual versus predetermined performance goal. . . .			38	35%	
Efficiency of resource utilization.			31	28%	109
Net cash flow			5	5%	
Net present value (or project basis).			4	4%	
Other forms of evaluation			4	4%	
Total Response to Inquiry			159*	146%*	109

SOURCE: Corporations responding to questionnaire.

*Response percentage exceeds 100% because 20 out of 109 firms gave multiple answers to this inquiry.

TABLE 12 shows that 51 percent of the firms responding to this inquiry do not use ROI or residual income in isolation. Some firms even use multiple auxiliary measures to supplement ROI and residual income results. The disturbing fact, however, is that the other 49 percent of the responding firms rely exclusively on ROI or residualincome in their assessment of managerial performance. Considering the present composition of these tool measures, the firms who rely exclusively of their results appear to treading on dangerous ground with respect to faulty as well as unfair evaluative results being generated.

The firms using the above tools were next requested to rate each tool classification on the basis of the tool's evaluative effectiveness as well as each tool's ability to positively motivate segment management in lite of overall firm goals. The evaluative ratings in both respects are shown in TABLE 13 (page 74). It is interesting to note that both ROI and residual income scored more (though not outstanding) points regarding their evaluative effectiveness as opposed to their motivational potential. In fact, the majority of rating firms indicated that either these tools need improvement or these tools were totally inadequate for motivational objectives. These findings indicate a need for additional examination of the return on investment and residual income tool measures in the areas of both evaluative effectiveness and motivational direction.

TABLE 13

EVALUATION OF INVESTMENT CENTER PERFORMANCE MEASUREMENT TOOLS: EFFECTIVENESS AND MOTIVATION

MEASUREMENT TOOL QUALITIES	TOTAL FIRMS 100%*	MEASUREMENT TOOL EVALUATION: EFFECTIVENESS / MOTIVATION		
		SATISFIED WITH TOOL	TOOL COULD BE IMPROVED	TOOL IS INADEQUATE
The Measurement Tools as Effective:				
ROI.	209	48%	48%	4%
Residual Income. . .	31	55%	39%	6%
Other Tools.	109	50%	48%	2%
The Measurement Tools as Managerial Motivators:				
ROI.	209	41%	49%	10%
Residual Income. . .	31	36%	61%	3%
Other Tools.	109	42%	57%	1%

SOURCE: Corporations responding to questionnaire.

*Information derived from TABLES 9 and 12.

SUMMARY

The use of either ROI or residual income on a regular basis in evaluating segmental managerial performance is steadily increasing. Today, most companies with two or more investment centers employ either or both of these measures. Thus, decentralized profit responsibility has become decentralized investment-return responsibility. With this broadening of managerial responsibility comes the need to carefully distinguish between the evaluation of the investment center and the evaluation of its management. As mentioned previously, whether one uses ROI or residual income in evaluating segment management performance, top management must be mindful of the operating constraints to which the segment manager is exposed, for his ability to produce profits is limited by market conditions, by the scope of authority delegated to him, and by the historical background of the operations and facilities that fall within his jurisdiction. Accordingly, his performance should be evaluated in terms of his success in producing results within these constraints. In the final analysis, what is needed is a comparison of actual performance with some standard of desired performance, tailored to the environment in which the investment center manager must operate. Furthermore, whether the tool used is ROI or residual income is only one aspect of the problem associated with segmental managerial evaluation. From the information

conveyed in TABLE 13, it is obvious that there is a great deal of misunderstanding regarding the motivational and behavioral consequences of performance measures. In addition, and related to this issue, is the problem associated with measurement tool composition because with ROI and residual income, the nature and extent of tool content is far from uniform. Thus, profit base and investment base criteria must be defined in such a way so that their combined relationship provides both an effective means of evaluation and a positive catalyst for managerial motivation. The remaining chapters of this study are devoted to this effort within the general framework of ROI and residual income methodology.

Chapter 4

ANALYSIS OF INVESTMENT CENTER PROFIT: CONTEXT AND COMPOSITION

In order to evaluate investment center managerial performance, it is necessary to determine a measure of both the periodic segmental profit and the asset base employed in generating this profit. Although each of these components presents a distinct measurement problem, they are inherently related in the following respects:

1. Both the investment base and profit must be controllable by the investment center manager if he is to assume responsibility and therefore be evaluated on either of these measures, and

2. Many elements that affect the investment base also affect segmental expenses either through a direct or inverse relationship, and subsequently affect the final profit determination as well.

Within the context of the above interrelationships, this chapter examines the profit base definition and its derivation. Chapter 5 presents a contextual and compositional analysis of the segmental investment base.

INVESTMENT CENTER PROFIT EVALUATION: JUSTIFICATION AND PREREQUISITES

The need for segmental profit evaluation arises when management desires to determine the degree of investment center profit contribution to overall corporate profit. To the extent that segment management is delegated adequate decision authority to control its revenue and expenses, the concept of profit measurement becomes relevant and grows in both importance and effectiveness. As the operations of the firm's segments become more dependent upon the operations of other related segments, the segment manager's freedom of decision making and the need for profit evaluation diminishes. Under the assumption that adequate decision authority exists, the justification for segmental profit evaluation can be rationalized on the basis of the following four objectives:[30]

1. Profit evaluation provides an indication of the profitability of the investment in individual divisions, markets, or product lines,

2. Profit evaluation serves to increase segment management's awareness of the company's profit objectives,

3. Profit evaluation guides segment managers toward decisions that will increase total company profit, and

4. Profit evaluation gives top management some indication of the effectiveness of segment managers in exercising the authority delegated to them.

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[30]Shillinglaw, "Problems in Divisional Profit Measurement," op. cit., p. 34.

Quite often, however, the difficulties that arise in profit decentralization stem from the fact that this singular figure called "profit" is asked to do too many things simultaneously and without appropriate foundation. In this regard, Shillinglaw outlines the following three rules with which profit measurements must comply before they can be relevant as acceptable measures of performance:[31]

1. Segment profit should not be permitted to increase by any action that is detrimental to total company profit,

2. Each segment's profit should be as independent as possible of performance efficiency and managerial decisions originating elsewhere in the company, and

3. Each segment's profit should reflect all items that are subject to any substantial degree of control by the segment manager or his subordinates.

To what degree does profit, defined in accordance with generally accepted accounting principles, possess the capacity to fulfill the above-mentioned prerequisites? To help in providing an answer to this inquiry, attention is directed to the context and derivation of the accounting profit measure.

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[31]Gordon Shillinglaw, Cost Accounting: Analysis and Control (Illinois: Richard D. Irwin, Inc., 1961), p. 668; see also his articles, "Guides to Internal Profit Measurement," Harvard Business Review, 35 (March-April, 1957), 82-94 and "Toward a Theory of Divisional Income Measurement," The Accounting Review, XXXVII (April, 1962), 208-216.

ANALYSIS OF VARIOUS CONCEPTS OF PROFIT: DETERMINATION AND SIGNIFICANCE

In the determination of either return on investment or residual income, the profit element is generally taken directly from an investment center's income statement which is prepared in accordance with generally accepted accounting principles. Accordingly, TABLE 14 (page 81) reveals that 76 percent of the responding firms use operating net income either before or after the deduction of income taxes as the profit base in the ROI calculation. In addition, 24 out of 29 firms which use both ROI and residual income in assessing segment management performance utilize these same profit concepts in both measurement calculations. Several comments received from responding corporations indicate that in some instances "income" is still regarded as some kind of single-value, all-purpose truth. However, under different situations income, as a concept, means different things to different people. For example, Chambers states that it is possible to measure a given firm's (or in this case firm segment's) income in as many as 30 million different figures, all of which are determined in accordance with generally accepted accounting principles.[32] Therefore before income can be used in conjunction with any measure

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[32]Raymond J. Chambers, "A Matter of Principles," The Accounting Review, XLI (July, 1966), 443-457.

TABLE 14

ANALYSIS OF ROI PROFIT BASE

CONTEXT OF ROI PROFIT	ROI PROFIT BASE		TOTAL FIRMS 100%
	TOTAL FIRMS	PERCENTAGE OF TOTAL	
Contribution Margin	4	2%	
Performance Margin.	10	5%	
Segment Margin.	36	17%	209
Net Income before Taxes	88	42%	
Net Income after Taxes.	71	34%	
Total Response to Inquiry	209	100%	209*

SOURCE: Corporations responding to questionnaire.

*Only firms utilizing ROI were examined on this inquiry because the vast majority of firms using residual income define income for this purpose as net income before taxes.

of managerial effectiveness, it is essential to clarify its composition. More specifically, if income is to be a "fair" indicator of managerial performance, the various factors contributing to its substance must be properly isolated into controllable and noncontrollable elements. This difficulty reduces itself to a determination as to what should be included in, and what should be excluded from, the final product known as "net income." In this derivation, however, there are numerous levels of "net-ness" relative to income. These "net-ness" relationships for ROI and residual income determinations are conceptually illustrated in FIGURE 6 (page 83).[33] With reference to this illustration, it should be immediately obvious that the statement structure outlined cannot be derived according to the traditionally functional approach used in external financial reporting; nor can this structure be fully developed through exclusive application of the behaviorally-oriented approach coverted by direct costing. Instead, a combination of the above approaches set within

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[33]For additional discussion of profit levels, though in some cases defined differently, see Charles T. Horngren, Cost Accounting: A Managerial Emphasis (3d ed.; New Jersey: Prentice-Hall, Inc., 1972), pp. 399-402; see also the articles by Russell B. Read, "Various Profit Figures and Their Significance," N.A.A. Bulletin, 39 (September, 1957), 32-37, William L. Strong, "Decentralized Operations: A Control Program," Financial Executive, 26 (January, 1958), 11, and Patrick S. Kemp, "Contribution Margin Analysis by Company Segments: Three Uses," N.A.A. Bulletin, 44 (November, 1962), 29-37.

	RETURN ON INVESTMENT	RESIDUAL INCOME
Net Sales	$x,xxx	$x,xxx
Less: Controllable Variable Segmental Cost of Goods Sold	-x,xxx	-x,xxx
Gross Margin.	$x,xxx	$x,xxx
Less: Controllable Variable Segmental Marketing and Administrative Expenses. . .	-x,xxx	-x,xxx
Contribution Margin	$x,xxx	$x,xxx
Less: Fixed Expenses Directly Identifiable with and Controllable by Segment. . .	- xxx	- xxx
Performance (Controllable) Margin . .	$x,xxx	$x,xxx
Less: Interest on Controllable Segmental Investment Base (or Capital Charge Rate) . .		- xxx
Controllable Residual Income Margin .		$x,xxx
Less: Other Expenses Directly Identifiable with but not Controllable by Segment. . .	- xxx	- xxx
Segment Margin.	$x,xxx	
Less: Interest on Noncontrollable Portion of Segmental Investment Base.		- xxx
Segmental Residual Income Margin. . .		$x,xxx
Less: Allocated Common or Extra-Segmental Expenses Neither Directly Identifiable with Nor Controllable by Segment.	- xxx	- xxx
*Net Operating (or Net Residual) Income before Taxes	$x,xxx	$x,xxx
Less: Estimated Taxes on Operating Net Income	- xxx	- xxx
Net Operating (or Net Residual) Income after Taxes.	$ xxx	$ xxx

FIGURE 6

CONCEPTUAL ILLUSTRATION OF DEGREES OF "NET-NESS" FOR ROI AND RESIDUAL INCOME DETERMINATION

*This is the profit measure most often used in both ROI and Residual Income derivation.

an overall framework of responsibility analysis is essential in order to develop the levels of income specified. The nature and composition of each of the profit levels noted in FIGURE 6 are next examined.

Contribution Margin

Contribution margin is obtained by deducting segment variable controllable cost of sales, marketing, and administration from net sales. In deriving this level of profit, the primary focus is on cost control in the investment center rather than on overall performance evaluation. As such, the concept of direct costing, though applied in deriving this calculation, is modified slightly in order to further distinguish between controllable and noncontrollable variable cost behavior patterns. Therefore, at the investment center evaluative level, the primary interest in obtaining a measure of contribution margin is with determining the vested responsibility for direct segment expenses rather than with merely noting a distinction between the expenses direct and indirect nature. Accordingly, the overall objective of deriving contribution margin within the responsibility scope specified is to reflect a segment manager's direct operational contribution to fixed and company-wide controllable expenses.

Performance Margin

Performance margin differs from contribution margin

in that fixed costs, under the discretionary decision influence of the investment center manager, are also deducted. Furthermore, only those fixed costs subject to control in the short run are deducted. Thus, all committed investment center fixed costs, regardless of whether the committment itself originated with the present or some previous investment center manager, are eliminated from consideration. Current discretionary segment managerial control is the key in deriving this measure of profit performance. As such, intersegmental comparison of current managerial contribution can be initiated on a sound and reasonable basis in order to isolate weak segment managers (as opposed to isolating weak segments, which is not the purpose of this measure). In so doing, performance margin is a superior measure to contribution margin because the former measure includes discretionary fixed costs in profit consideration, and these may well have an interacting effect on the variable costs that contribution margin analysis considers exclusively. Additionally, derivation of this performance margin or controllable profit figure possesses the following two-fold advantage according to Read.[34]

1. Performance margin specifies the profit over which the segment manager can exercise immediate and direct control through his decisions and actions, and

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[34]Read, op. cit., p. 35.

2. Performance margin encourages a better understanding of the segment's cost, since the determination of this figure forces a segregation between costs which are controllable and those which are not in the short run. More specifically, it focuses on an analysis of fixed costs between those which are fixed by committment and those which are fixed by operating policy.

With respect to item two above, one of the most difficult expense items to classify as controllable versus uncontrollable in the short run analysis is depreciation. If classified as uncontrollable (and excluded from the performance margin figure) the following adverse situation could arise: A segment which substitutes capital equipment for labor over a period of time would show a steady rise in controllable profit--all other things being equal--because the compensating rise in depreciation would only be reflected below this controllable profit line. Consequently, a real danger exists that controllable profit improvement may be shown in situations where no real improvement has occurred, simply by substituting so-called uncontrollable inputs for controllable inputs (equipment for direct labor in this case). The probability of this situation arising can be substantially reduced, however, if it is realized that, corresponding to a distinction between controllable and noncontrollable expense, is the need to also consistently distinguish between controllable and noncontrollable investment base resources. Therefore, concept consistency

dictates that the cost of using controllable investment is a controllable expense and should be deducted in determining the controllable profit margin. Further discussion relative to investment base controllability is deferred to the next chapter.

Segment Margin

The segment margin profit measure is derived after deducting from the performance margin those directly identifiable segmental fixed costs that are fixed by some prior committment and are therefore considered as uncontrollable by the segment manager in the short run. In essence, this profit measure is derived after full consideration of all directly traceable committed and discretionary segment costs. As such, it is this profit measure for which the segment itself (separate and apart from the segment manager) can be held responsible, if the firm so desires to draw an assessment of total segmental contribution to company-wide expenses. The necessity for this differentiation between segment and segment manager evaluation stems from the fact that many corporations deliberately assign their best managers to their least successful segments in the hope of improving the latter's performance. In addition, the parameters of control tend to be broader on a segment as opposed to segment manager level. Thus, the need arises to establish responsibility boundaries. Lastly, performance measures involving segmental management are, by necessity,

short-term in nature since segment manager turnover and other factors will contribute to a terminal existence for managerial personnel. Segment measures, on the other hand, tend to be more long-term in nature due to the survival viability of this subentity over and above the survival of any specific management team. For these reasons, the distinction between activity versus manager profit evaluations must be drawn. Relative to managerial evaluation, the use of segment margin, then, would be inappropriate, since this figure involves long-term considerations which may have little relationship to the operational effectiveness of present segmental management.

Pretax Net Operating Income

The pretax profit measure is determined by deducting allocated common or extra-segmental expenses from the segment margin figure. Operating income, in this respect, reflects a segment's ultimate contribution to overall firm profitability prior to tax considerations, and is the measure of profit (as revealed in TABLE 14) that most firms use in determining segmental ROI and residual income. A criticism of this profit measure is that it is difficult to imagine how segmental managerial performance can be assessed when deductions are made for both central and common costs over which the segment manager exercises no influence. The counter-argument most commonly used by corporations according to Solomons is that segments must

be made aware of the fact that there are nonsegmental costs to be covered out of segment earnings before the company as a whole can show a profit. Moreover, if the segment was an independent company, it would have a top management of its own and, therefore, would itself incur many of the expenses presently allocated.[35] As convincing as this argument may seem, the fact remains that in a responsibility evaluation system, net operating income as a means of relevant segmental performance appraisal is arbitrary to the extent that allocated expenses are arbitrary. Also, due to its sense of all-inclusiveness, any attempt to refine this profit measure through investment center fractionalization is misleading, because the results of the whole will necessarily differ from the sum of its segmented parts. This effect is due to the synergistic reaction on the corporate level caused by the consolidation of coordinated subsystem efforts.

Net Operating Income After Taxes

After tax profits possess the same nature of arbitrariness as before tax profits with one additional dimension. Segments, unless organized as separate corporations, do not pay income taxes since taxes are levied on the legal entity only. As such, tax policy is invariably a corporate

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[35]Solomons, op. cit., p. 73.

not a segment responsibility and is therefore not controllable at this lower level. Despite this reasoning, 34 percent of the responding firms (as shown in TABLE 14) use after tax profits in their ROI calculation. Following Solomons' sense of logic expressed on the previous page, the rationalization for utilizing after tax profit (as opposed to some other less inclusive measure) in segmental managerial evaluation seems to be that in a decentralized operation, this profit concept comes closest to approximating performance as if the segment had operated as an independent entity. Additionally, along the line of the decentralization philosophy, corporate management is probably attempting to establish in its investment centers a climate paralleling that of an autonomous firm. In doing this, however, top corporate management loses sight of the fact that an internal segment is not divisibly self-sustaining and its management does not possess complete decision authority.

Up to this point, the discussion has eliminated both before and after tax profit measures from serious consideration as viable and meaningful measures of either segmental or segmental managerial performance effectiveness. In addition, segment margin, though a viable means of assessing segment performance, has also been disputed as an inappropriate measure of segmental managerial effectiveness. The primary reasons for eliminating all three profit

measures stem from the contention that these profit derivations are, by their very nature, "unfair" from the viewpoint of the segment manager who is subject to this evaluation. This unfairness premise arises from the fact that all the above measures include uncontrollable and often allocated elements in their determination. Additionally, these profit measures all emphasize some degree of long-term profit contribution, when, in actuality, both ROI and residual income should seek to determine the short-term performance effectiveness of current investment center management. An equally important reason for excluding the before and after tax profit measures in internal evaluations is that, as determined in accordance with generally accepted accounting principles, derivation of these profit measures and a managerial attempt to maximize the same could breed adverse motivational tendencies in the short run. The end results of this incongruent motivation, considering the two extreme reactions, are short-run profit manipulation as a minimum and long-run profit suboptimization as a maximum consequence. Factors which cause each of these adversities will now be examined.

FACTORS CONTRIBUTING TO MANIPULATION AND SUBOPTIMIZATION OF PROFIT

The contention in this study is that adverse motivational consequences are due primarily to forced managerial emphasis on the maximization of an inappropriate segmental

profit goal. Accordingly, the segment manager is motivated to maximize the profit factor on which he is to be evaluated, as motivation and evaluation are two sides of the same coin. In an attempt to maximize his stated profit goal, the segment manager logically pursues the most direct route, but this direct route may not be the most profitable one from either a long-term or overall corporate viewpoint. One of the greatest dangers, then, in decentralizing profit responsibility is the motivation that it generates for short-run profit accomplishments. In this respect, Dearden lists the following four situations where the motivation for short-term profits is so intense that profit manipulation or profit suboptimization could materialize:[36]

1. When a firm has decentralized because it previously experienced difficulty in earning an adequate profit, or

2. When a segment manager is replaced because the segment itself is not earning a satisfactory profit (in this case the new manager feels compelled to obtain instant results), or

3. When a segment manager believes that he is "on the skids" (in this case he has everything to gain and nothing to lose), or

4. When a segment has been earning a satisfactory

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[36]John Dearden, "Limits on Decentralized Profit Responsibility," Harvard Business Review, 40 (July-August, 1962), 87-88.

profit but a new manager wishes to make a name for himself.

In the above-outlined adverse situations, generally accepted accounting principles reinforce managerial motivation in this direction of short-term profit achievement. In addition, use of procedures in accordance with these principles enables the segment manager to either manipulate or suboptimize profits because generally accepted accounting principles provide the loopholes by which either consequence can materialize. Several examples illustrating how a segment manager can manipulate or maximize profits to his own advantage (as opposed to that of the overall corporation) are presented below. However, one must keep in mind that if a segment manager decides to take such action, it could also influence the derivation of his investment base. This latter effect is discussed in the next chapter.

Profit Manipulation Examples

Of the two adverse consequences discussed above, profit manipulation tends to be less serious than profit suboptimization because, in the long run, the results of manipulative techniques level out and are reconciled. The fact still remains, however, that performance effectiveness within a short-term time frame may be seriously distorted by managerial actions resulting from internal application of procedures sanctioned by external accounting principles. The following examples demonstrate this point:

Last-in, first-out valuation. This form of inventory

valuation enables a segment manager to vary his profit by simply adding or deleting end-of-period purchases contrary to overall segment needs. Assuming a rising trend in cost prices, a segment manager can increase his profit by deleting an essential end-of-period purchase. Of course, a reciprocal effect of this deletion could be stock-out conditions arising at the beginning of the next period. On the other hand, if cost prices are instead falling, segment profit can be increased by adding an unnecessary end-of-period acqusition of merchandise. Doing so, however, would also result in tying up corporate resources in unessential assets.

Absorption (full) costing. In accordance with generally accepted accounting principles, the basis for inventory accounting is cost. In this respect, cost means "the sum of applicable expenditures and charges directly or indirectly incurred in bringing an article to its existing condition and location."[37] Relative to manufactured inventory, although this definition does not exclude the direct costing concept, it certainly does not encourage its utilization for internal evaluation purposes. Consequently, far too many firms continue to use full costing methods internally. This is due to both the stated all-inclusive

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[37]Defined by the American Institute of Certified Public Accountants Committee on Accounting Procedure in Bulletin Number 43, cited by Wilmer L. Wright, "Direct Costing--Profit Measurement," N.A.A. Bulletin, 41 (September, 1959), 62.

requirements governing external financial reporting and the lack of sufficient internal distinction between product costing and performance evaluation data needs. The overall problem caused by absorption costing emphasis is that the segment manager is capable of increasing profits in the short run simply by increasing his production nonproportionately over sales and thereby manufacture for inventory buildup. Thus, profits under absorption costing tend to fluctuate with changes in production as opposed to changes in sales. Furthermore, the effect of absorption costing on the business operating cycle should be recognized. In this respect, when the business operating cycle is high, inventories are accumulated and true profits are overstated. Conversely, when this cycle turns down, accumulated inventories are worked off and true profits are understated thereby increasing or accentuating the depth of the cycle depression.

In addition to profit manipulation and business cycle effects, further criticism of the full costing methodology stems from the fact that this approach is neither behaviorally oriented nor responsibility oriented. Therefore, profit determined according to the conventional all-inclusive approach (from which the absorption costing concept is generally derived) draws no distinguishment between fixed and variable, divisible and indivisible, or controllable and uncontrollable cost data. Only the use of a responsibility-oriented system with behavioral cost

distinction can alleviate the measurement difficulties associated with the full costing methodology.

Depreciation determination. In a truely decentralized organization, investment center managers are given a large degree of freedom to choose their own internal depreciation methods while the choice of tax-oriented depreciation techniques are left to the corporate level without reference to the investment center selections. In fully developed segments, the depreciation methods selected will not distort resulting profits as seriously as in growth-oriented segments. The reason for nondistortion of profits in the developed segments is that the age of assets tends to be more evenly distributed coupled with the fact that the resulting depreciation charges are lower relative to other expense effects on profit derivation. Regardless of the degree of segmental development, however, the internal selection of depreciation methods should be guided by an asset's expected performance, not by such considerations as tax minimization and segmental uniformity. What is important, then, is that each segment's reported profit reflect as accurately as possible the performance effectiveness of its management. As logical as this may seem, TABLE 20 (page 128 in Chapter 5) reveals that 95 percent of the responding firms use the same method of depreciation internally as they do for external financial reporting purposes. Consequently, primary emphasis in depreciation method

selection still tends to be placed on such considerations as tax minimization, procedural consistency, and segmental uniformity. As such, the opportunity for short-term profit manipulation and distortion can assume a number of dimensions. For example, application of the cost concept in its traditional form distorts and falsifies plant asset derived profits because input depreciation charges are valued in dollars of higher purchasing power than are the output revenue factors. Furthermore, the use of external depreciation methods for internal evaluations tends to overstate "real" profit as the related plant assets age because these external depreciation methods fail to properly reflect the loss in plant asset operating utilization over time. In addition, Dearden[38] cites several situations in which the assignment of plant assets to segments at their gross cost while accounting for depreciation using a composite rate, encourages segment managers to prematurely eliminate temporary idle facilities. In Dearden's examples, a segment, in disposing of these facilities, escapes the related depreciation charge as well as any loss on this premature disposal. The foregoing depreciation examples not only dispute the necessity for internal and external method consistency and uniformity, but also point out the shortcomings of using the historical cost concept in plant

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[38]John Dearden, "Problems in Decentralized Profit Responsibility," Harvard Business Review, 38 (May-June, 1960), 79-86.

asset valuation.

The profit distortion examples illustrated in the above sections are not the only instances that can be cited; they simply tend to be representative of the overall results that can materialize when there exists a combination of improper motivation and inappropriate measurement procedures. In the short run, the effect of manipulative practices can distort the performance appraisal process to such an extent that the profit figures derived can be quite different for two segment managers exhibiting identical actual performance.

Profit Suboptimization Examples

The primary forerunner to a suboptimization situation appears to be the existence of either intersegmental competition or intersegmental dependence. Suboptimization in either case is defined as the negative synergistic effect that is generated in the overall corporation when a segment optimizes its short-term performance to the short-or-long-term detriment of the corporate whole. It should be recognized at this point that an increase in one segment's profit over and above a related decrease in another segment's profit does not necessarily constitute suboptimization as the term is used in this study, because at least in the short run, the synergistic effects on the corporate whole are positive. The following examples demonstrate the way in which suboptimal situations arise:

Transfer pricing situation. Both segmental competition and interdependence can be reflected in the internal transfer of goods and services. The price at which these transfers is acknowledged simultaneously influences both the transferee's inventory base and the transferor's profit total. In addition, the smaller and more numerous the segments involved, the more important this reciprocal influence becomes, and the more dependent is the entire profit measure on the designated transfer price. Therefore, the motivating aspect of transfer prices is of primary importance because with improper or unfair internal prices, motivational tendencies arise that may lead to actions contrary to overall corporate interests. For example, an investment center manager does not have any incentive to give business to another internal segment if he can purchase from external vendors at a lower price. In this case, while the particular buying segment's profit may benefit due to the lower experienced purchasing costs, the corporation as a whole serves to lose the profit margin on intersegment sales which would otherwise be made. To illustrate this point from a slightly different angle, consider the following representative situation:

> A segment was purchasing an identical part from both an outside source and a company segment. The rules provided that, in cases of this type, the internal price would be exactly the same as the external price. The buying segment would be able to negotiate prices with the outside source more effectively if it had information relative to the manufacturing costs of the item in question. But

> the internal selling segment was reluctant to give any information relative to the product's cost for fear that the outside price would be reduced, causing the internal transfer price to also be lowered.[39]

In the above case, suboptimization results because without the pertinent cost information available internally, the buying segment will have to pay a higher price than it could otherwise negotiate if it had proper access to this cost data. Therefore, even though the internal selling segment optimizes its profit position, the corporation as a whole suffers to the extent of the higher external purchase price incurred by the buying segment.

Cost allocation. The position taken in this study is that indivisible and nontraceable costs should not be allocated in evaluating investment center managerial performance; however, to the extent that these allocations are presently made by corporations, a discussion of their potential suboptimizing effect is essential. As shown in TABLE 15 (page 101), only 29 percent of the firms utilizing investment center managerial responsibility do not allocate common costs, while the other 71 percent use singular or multiple methods of cost allocation. This high percentage is not too surprising in view of the fact that the vast majority of firms previously stated their utilization of before or after tax income as the profit base in their measure of

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[39]John Dearden, "Interdivisional Pricing," Harvard Business Review, 38 (January-February, 1960), 118.

TABLE 15

ANALYSIS OF SEGMENTAL COMMON COST ALLOCATION METHODS

NATURE OF COMMON COST ALLOCATION METHODS	ALLOCATION BASE		TOTAL FIRMS 100%
	TOTAL FIRMS	PERCENTAGE OF TOTAL	
Common costs are not allocated .	62	29%	
Sales.	69	32%	
Gross Profit	4	2%	
Assets Employed.	72	34%	215
Invested Capital	11	5%	
Number of Employees.	26	12%	
Other Methods**.	28	13%	
Total Response to Inquiry. . . .	272*	127%*	215

SOURCE: Corporations responding to questionnaire.

*Response percentage exceeds 100% because 35 out of 215 firms gave multiple answers to this inquiry.

**Other methods mentioned include the following with the degree of frequency in parentheses: Massachusetts formula (4), finished goods production volume (4), service provided basis (5), cost of sales (2), segment versus firm weighting basis involving assets and sales (3), various combinations of the above depending on the nature of the cost to be allocated (10).

ROI and residual income. In addition, the fundamental idea that individuals should be charged only with the costs under their exclusive control, though conceptually appealing, is difficult to apply practically because there are few elements of cost that are the sole responsibility of any one person, with evidence of this contention previously presented in TABLE 4. As such, for purposes of allocation analysis, managerial expenditure control assumes one or more of the following three frameworks:[40]

1. A segment manager is free to shop around and has the authority to accept or reject centrally produced inhouse services in favor of obtaining these services externally. In situations of this type, if the inhouse services are selected, the resulting cost is considered as fully controllable by the segment manager.

2. A segment manager is not free to select between internal and external service sources, but he is free to determine the extent to which he utilizes the inhouse services in question. In this case, only the quantity factor of the total service cost is controllable by the segment manager, while the price factor is controllable elsewhere in the organization (i.e., centralizing purchasing).

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[40]Solomons, op. cit., pp. 74-75 and Horngren, "Choosing Alternative Accounting Practices for Reporting to Management," op. cit., pp. 9-10.

3. A segment manager is not free to decide either the service origin or the quantity of the service he must utilize. If both decisions are determined elsewhere in the organization, then the resulting service expense is also fully controllable elsewhere in the organization.

Generally, it is within this third decision framework that many of the allocation problems originate. Difficulties in this respect seem to exist because of two inherent cost characteristics: A lack of cost-to-segment traceability and the existence of substantial indivisibilities in the cost item itself. All other things being equal, the magnitude of cost allocation is directly proportional to the degree of segmentation existing within a company; therefore, the magnitude of the related allocation problems varies accordingly. As such, suboptimal situations most often arise because of the utilization of faulty or unfair allocation techniques. These techniques may offend or discourage segment managers to the point of suboptimizing overall corporate profits in order to assure their own segment performance self-preservation.

To illustrate, assume that central administrative expenses are to be allocated to the various investment centers, and the allocation basis is investment center sales. Here, an adverse situation may occur if an investment center manager attempts to restrict his segment's sales in order to attract a correspondingly reduced expense

allocation. A segment manager would be likely to initiate precisely this type of action if he suspected that his added allocation expense share would be in excess of the contribution margin that could be generated on the sales in question. A case in point would evolve as follows: Assume that $20,000 of additional segment sales would increase this segment's contribution margin by $2,000 but would also attract an increase of $2,300 in central expenses by means of sales-based allocation. Relative to this illustration, if the segment manager consumates the additional sales, his segment's net income would decrease by $300. Conversely, if he fails to initiate these sales, the corporate profits as a whole would decline by $2,000 in lost segmental contribution. The above situation not only illustrates suboptimal motivation, but also shows how one segment's cost allocation may rise simply because, all other things being equal, another segment's sales have declined. In essence, a segment manager's cost may increase and his profits accordingly decrease by events entirely outside his realm of control when a sales basis is used for cost allocation. In this respect, TABLE 15 shows that 32 percent of the firms responding to this inquiry utilize the sales basis in their allocation of common costs.

Slight modification of the above example will also illustrate that it is possible to allocate costs on a basis that reflects no apparent rational relationship with respect

to segmental operations. To demonstrate this point, assume that instead of sales, the allocation of central administrative expenses is by means of segmental gross profit. In this case, then, the more profitable a segment is, the higher would be its proportional share of these central costs; yet, this consequence makes little sense because it is more rational to assume that the less profitable segments are the ones that require the greatest attention from central management.

Possibly the examples cited above help to explain the reason why investment center managers often construe the cost allocation process negatively as "creative accounting" designed to inhibit segmental goal attainment. Opening up the possibility for such a reaction, however, makes no sense at all because if nonsegmental and common costs are, in fact, completely independent of the segment manager's decision discretion, allocation would seem to be unnecessary as overall corporate profits would not be influenced anyway. Furthermore, Kemp notes two additional objections to the use of allocations in profit derivation designed to assess managerial performance:[41]

1. The fact that allocation is to some degree inaccurate frequently leads to contentions that it is unfair, and

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[41]Kemp, op. cit., p. 29.

2. It is illogical to assume that it is possible for company segments to earn a profit or sustain a loss, since they are not independent operating units to begin with, but are instead merely part of a greater whole.

Therefore, while the allocation process may have its rightful place in product cost determination, this same process can result in misleading and often meaningless information when applied in deriving performance evaluations. By its very nature, then, cost allocation is never accurate, and at best, it can only be said to be reasonable.

To summarize, the overall consequence of profit suboptimization tends to be more serious than profit manipulation. With profit manipulation, the effect is short term and normally fully reconciliable in the long run when timing lags in the matching process are eliminated; however, with profit suboptimization, the effect the more likely to be long term in nature, and furthermore, is not resolvable until the situation is perceived and specific action is initiated.

INFLUENCE OF VARIOUS LEVELS OF PROFIT ON ROI: THE SENSITIVITY ANALYSIS

Within this chapter, five specific levels of profit "net-ness" were identified and distinguished. The profit level selected in the measure of ROI can significantly effect the output ratio results, as shown in TABLE 16 (page 107). This table marks the beginning of the ROI

TABLE 16

ESTABLISHMENT OF ORIGINAL ROI SENSITIVITY PARAMETERS FOR CORPORATION USED IN SENSITIVITY STUDY

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	INCOME BEFORE TAXES	INCOME AFTER TAXES
INDUSTRIAL PRODUCT-GROUP INVESTMENT CENTERS					
Plant Assets @ BV	104.9%	58.5%	53.0%	47.5%	24.3%
Plant Assets @ Cost.	68.9%	38.4%	34.8%	31.1%	15.9%
Plant Assets @ BV + WC.	60.0%	33.4%	30.3%	27.1%	13.9%
Plant Assets @ Cost + WC . . .	46.2%	25.7%	23.3%	20.9%	10.7%
Total Assets @ BV	44.7%	24.9%	22.6%	20.2%	10.3%
Total Assets @ Cost.	36.6%	20.4%	18.5%	16.5%	8.4%
INDUSTRIAL PLASTICS PRODUCT-LINE SEGMENT					
Plant Assets @ BV	105.9%	38.1%	36.7%	33.0%	18.4%
Plant Assets @ Cost.	83.1%	29.9%	28.7%	25.9%	14.4%
Plant Assets @ BV + WC.	92.8%	33.4%	32.1%	29.0%	16.1%
Plant Assets @ Cost + WC . . .	74.8%	26.9%	25.9%	23.3%	13.0%
Total Assets @ BV	59.4%	21.4%	20.5%	18.5%	10.3%
Total Assets @ Cost.	51.5%	18.5%	17.8%	16.0%	8.9%
INDUSTRIAL CHEMICALS PRODUCT-LINE SEGMENT					
Plant Assets @ BV	87.2%	64.1%	57.4%	52.2%	24.9%
Plant Assets @ Cost.	43.6%	32.0%	28.7%	26.1%	12.4%
Plant Assets @ BV + WC.	48.6%	35.7%	32.0%	29.1%	13.9%
Plant Assets @ Cost + WC . . .	31.2%	22.9%	20.5%	18.6%	8.9%
Total Assets @ BV	36.7%	27.0%	24.2%	21.9%	10.5%
Total Assets @ Cost.	25.8%	19.0%	17.0%	15.4%	7.4%
INDUSTRIAL SYNTHETICS PRODUCT-LINE SEGMENT					
Plant Assets @ BV	160.7%	89.1%	79.6%	69.2%	35.6%
Plant Assets @ Cost.	152.7%	84.7%	74.7%	65.8%	33.9%
Plant Assets @ BV + WC.	57.8%	32.1%	28.3%	24.9%	12.8%
Plant Assets @ Cost + WC . . .	56.8%	31.5%	27.7%	24.4%	12.6%
Total Assets @ BV	46.2%	25.5%	22.6%	19.9%	10.2%
Total Assets @ Cost.	45.5%	25.2%	22.2%	19.6%	10.1%

SOURCE: Corporation participating in sensitivity study.

sensitivity analysis mentioned in Chapter 1, and contains the original return on investment parameter values that will be subsequently tested for sensitivity. Data for this table was obtained from TABLES 2 and 3 (pages 18 and 19) which outline the test firm's balance sheet and income statement respectfully. Relative to TABLE 16, the primary observation at this point in the analysis is the volatile response of the ROI ratio relative to input composition. Construction of the various matrices throughout this study will enable this ROI rate variability to be assessed in two ways:

1. By selecting a specific investment base level and reading each matrix horizontally, the effect of different levels of profit on ROI can be ascertained, and

2. By selecting a specific level of profit and reading each matrix vertically, the effect on ROI of various investment base compositions can be interpreted.

Also worth noting in TABLE 16 is the fact that most of the return rates in both the plastics and synthetics sectors exceed those initial rates established for the industrial product group as a whole. As will be demonstrated in the next chapter, a situation of this type could create the framework for suboptimal product-line decision making. Lastly, although this sensitivity analysis works exclusively with the return on investment tool, the the direction of sensitivity would not significantly differ

if the tool tested were instead residual income. Before proceeding further with this sensitivity analysis, an examination of investment base context and composition is essential. This examination will be pursued in Chapter 5.

SUMMARY

An investment center manager in his decision process cannot be expected to ignore the effect of his actions on his segment's overall profitability. As demonstrated in this chapter, profit calculated in the traditional manner in accordance with generally accepted accounting principles may breed situations in which the resulting decision process is less than optimal to the corporation as a whole. In a sense, "If one optimizes the performance of the liver, one will kill the body." Corporations may be courting this same fate through its encouragement of segmental profit performance. Thus, decisions may be made that improve segmental "reported" profit but at the time time adversely affect the firm's "real" profit performance. To this extent, then, profit derived in accordance with generally accepted accounting principles may be more the result of the accounting procedures applied than with the investment center manager's performance that it is suppose to reveal. In view of this observation, net operating profit, inclusive of uncontrollable short run and allocated costs, is an inappropriate measure of managerial profit effectiveness.

Chapter 5

ANALYSIS OF INVESTMENT CENTER RESOURCE BASE: CONTEXT AND COMPOSITION

The percentage of profit to net sales, or for that matter any other measure of profit performance, does not constitute a complete assessment of managerial effectiveness because profit measures fail to consider the resources employed in generating revenues on which profit margins have been earned. Thus, in the derivation of either ROI or residualincome, a measure of the segmental investment base must also be determined.

In order to correspond with the derivation of profit discussed in Chapter 4, the investment base measure should also be remotely related to the segmental balance sheet prepared in accordance with generally accepted accounting principles. While top management may be somewhat cognizant of the profit measure problems, its methods of resource base determination seem to indicate that corporate management does not recognize the more serious limitations inherent in the traditionally derived investment base. As such, top management may fail to recognize the limitations associated with the application of the investment center responsibility concept. Evidence to support this contention

will be presented in the following investment base discussion.

INVESTMENT BASE: CONTEXTUAL DEFINITIONS

If a company's objective is to measure the performance effectiveness of segmental management, investment is defined as the assets placed at the manager's disposal. In terms of practical application, the companies surveyed expressed differing points of view as to how this base should be defined.[42] In general, the concepts used by these firms seem to coincide with the following definitional variations cited by the National Association of Accountants.[43]

1. Investment base is defined as "total assets available." If one uses this definition, the base consists of the total assets entrusted to management custody, regardless of where such assets originate. This definition also fails to consider the fact that some of these assets may not, at the present time, be capable of producing any type of return.

2. Investment base is defined as "total assets employed." If this concept is adopted, excess or idle assets are eliminated from the investment base.

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[42]This observation is based on a general examination of completed questionnaires submitted by responding firms.

[43]National Association of Accountants, Return on Capital as a Guide to Managerial Decisions, Research Report Number 35 (New York: National Association of Accountants, 1959), p. 35.

3. Investment base is defined as "total assets employed in operations." This more restrictive definition excludes from the base all nonoperating assets and current assets held to pay short-term creditors.

The overall problem with the preceding definitional interpretations is their failure to adequately distinguish between segment manager "control" and "custody" as these relate to the segment's asset resources. In view of this weakness, a fourth definition of the investment base is offered for consideration in this study:

4. Investment base is defined as "controllable assets employed within a segment."

It should be noted that the above definition includes part of interpretations two and three and also emphasizes the role of control as opposed to mere custody of resources.

INVESTMENT BASE DERIVATION PROBLEMS

In determining the elements which should be included in or excluded from a segment manager's investment base, the emphasis in this study is placed on "substantial" managerial control over the resources in question, because as indicated earlier, few assets are exclusively controllable at this level in the organization. Furthermore, no attempt is made to define the degree of control implied by the term substantial, as this should be determined in individual firms by mutual agreement between segmental and

top management. In addition to this problem of resource inclusion or exclusion, the valuation of resources included in the definition of the investment base must be determined.

CURRENT ASSET COMPONENT OF THE INVESTMENT BASE

As shown in TABLE 17 (page 114), the vast majority of responding firms believe that current assets are controllable by the segment manager and should, therefore, be included in his resource base. The assets normally included in the current base are cash, external receivables, and inventory.

Valuation of Included Current Assets

Although the valuation of current assets included in the investment base tends to vary among companies, the following sections examine the methods which industry practice and an examination of related literature indicate are the most often utilized.[44]

Cash. In most cases a segment manager does not have the authority to manage cash balances because centralized control often provides for more efficient utilization of this resource. At the same time, however, many firms wish to hold the segment manager responsible for the "normal"

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[44]John Dearden, "Problems in Decentralized Financial Control," Harvard Business Review, 39 (May-June, 1961), 73-77; see also Solomons, op. cit., pp. 146-147 and Terborgh, op. cit., pp. 43-44.

TABLE 17

ANALYSIS OF SEGMENTAL INVESTMENT BASE:
CURRENT ASSET SECTION

QUESTIONNAIRE INQUIRY AND ASSET BASE RESPONSE	CURRENT ASSET SECTION OF INVESTMENT BASE						TOTAL FIRMS 100%
	YES		NO		NOT APPLICABLE		
	TOTAL FIRMS	PERCENTAGE OF TOTAL	TOTAL FIRMS	PERCENTAGE OF TOTAL	TOTAL FIRMS	PERCENTAGE OF TOTAL	
Are the following current assets included in a segment's resource base?							
Cash.	140	65%	71	33%	4	2%	
Intrafirm Receivables . .	120	56%	82	38%	13	6%	
Trade Receivables	213	99%	2	1%			
Raw Material Inventory. .	211	98%	2	1%	2	1%	
Work-in-Process Inventory	211	98%	2	1%	2	1%	215
Finished Goods Inventory.	211	98%	2	1%	2	1%	
Other Current Assets. . .	172	80%	41	19%	2	1%	
Are L.I.F.O. based inventories adjusted, before base inclusion to reflect approximate replacement value?.	33	15%	51	24%	131	61%	

SOURCE: Corporations responding to questionnaire.

amount of cash that he would require if he was operating an independent business. In this situation, cash is often allocated to the segmental investment base by means of a predetermined formula. In this respect, the most popular allocation basis tends to be dollar sales or sales volume. Three objections to the use of sales as a basis of allocation are:

1. When sales are low, a minimum amount of cash is included, thereby mitigating the overall effect of reduced profits in performance assessment,

2. Costs, not sales, makes the maintenance of a cash balance essential. The sales basis is therefore arbitrary and not representative of segmental cash needs, and

3. In growth segments, if sales is used to allocate cash, segmental investment will be overstated due to the lack of equality between sales and the use of working capital resources. Furthermore, the whole idea of including cash in the controllable investment derivation is questionable, because no method of allocation, however "fair" it may be, can render a noncontrollable resource as controllable.

Trade receivables. Whether external receivables are a controllable component of managerial resources on the segment level depends on whether credit and account collection control is centralized or decentralized. Assuming the latter, the valuation of these included receivables

presents a less formidable task than the treatment of cash because segmental receivable divisibility is far easier to ascertain. As such, external receivables are normally included in the base at their actual end-of-period account balances. A criticism of the use of this method of valuation is that it can lead to both short-term distortion in segmental profit performance and possible suboptimal decision actions with long-term consequences. For example:

> A segment manager insisted that an all-out effort be made to collect as much as possible of his accounts receivable (many of them only a day or two delinquent) at the end of the period in question. This not only caused unnecessary additional collection expenses to be incurred in the short run, but, more importantly, created much ill will on the part of this segment manager's customers.[45]

Inventories. Since the segment manager generally has authority over this asset category, inventory quantities are usually included in the investment base by direct identification. The only control exception relates to the centralized purchasing of raw materials, however, unless price fluctuations are severe, very little problem is presented by this situation since quantity is generally more significant than price. In addition, the segment manager can indirectly influence the price to be paid by either changing re-order levels or adjusting production schedules. In both cases, the timing of the related raw

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[45]Dearden, "Problems in Decentralized Financial Control," op. cit., p. 76.

material purchase is effected, and if price fluctuations are the rule, the time of entry into the market assumes importance. Furthermore, by possessing the above decision discretion, segment management can control the level of product inventory. As such, the primary threat to corporate optimization is the possibility of inventory stockouts materializing, because when inventory quantities increase, all other things being equal, both ROI and residual income tend to decrease.

In valuing these inventory quantities, accounting book values are normally used. Thus, additional problems relative to this form of valuation can emerge. The specific problem caused by L.I.F.O. valuation in the investment base is examined in the next section.

Current Asset Valuation Adjustments

Valuation adjustments may be necessary to correct inequities that can otherwise result from the use of external reporting valuations for internal measurement purposes. The foremost example of the need for adjusting current assets is the situation where a firm uses last-in, first-out inventory valuation. TABLE 17 shows that 39 percent of the responding firms use L.I.F.O. valuation on external statements and of this 39 percent, 60 percent do not readjust inventory values when deriving the investment base. In addition to the danger of profit manipulation cited in Chapter 4, two further problems emerge when L.I.F.O.

valuation is allowed to enter the investment base:

1. The inventory valuation that results will rarely be representative of either actual inventory cost or inventory present value, and

2. Older segments are not encouraged to cut inventory quantities to the most efficient level possible in periods of inflation for fear that they will have to relinquish low inventory values.

The ROI ratio can also be significantly affected by the choice of valuation methods. To illustrate this point, the following situation was adapted to the corporation participating in the sensitivity analysis in order to test the relative sensitivity of the ROI parameter values previously shown in TABLE 16 (page 107):

> An assumed conversion from F.I.F.O. to L.I.F.O. valuation occurred at the end of 1974. As a result, the industrial product group and its three related product-line segments experienced the following decrease in their inventory base and profit as of the close of 1974:
>
> | | | |
> |---|---|---|
> | Plastics | = | $ 100,000 |
> | Chemicals | = | 828,000 |
> | Synthetics | = | 100,000 |
> | Total Product-Group | = | $1,028,000 |
>
> From the above, it is obvious that the chemicals segment is the oldest of the three. The synthetics sector, though the youngest segment, has a large quantity of inventory on hand in comparison with the plastics sector, as shown in TABLE 2 (page 18).

The results of this sensitivity test are shown in TABLE 18 (page 119). As indicated in this tabulation, the ROI ratio is most sensitive to the oldest segment and least

TABLE 18

SENSITIVITY OF ROI ASSUMING INVENTORY VALUATION CHANGED FROM FIFO TO LIFO DURING 1974

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	INCOME BEFORE TAXES	INCOME AFTER TAXES
INDUSTRIAL PRODUCT-GROUP INVESTMENT CENTERS					
Plant Assets @ BV	-22.3%	-22.3%	-22.3%	-22.3%	-10.2%
Plant Assets @ Cost.	-14.6%	-14.6%	-14.6%	-14.6%	- 6.7%
Plant Assets @ BV + WC.	- 5.8%	- 9.7%	-10.2%	-10.6%	- 4.6%
Plant Assets @ Cost + WC . . .	- 5.8%	- 8.0%	- 8.3%	- 8.6%	- 3.8%
Total Assets @ BV	- 5.8%	- 7.8%	- 8.1%	- 8.3%	- 3.7%
Total Assets @ Cost.	- 5.3%	- 6.7%	- 6.8%	- 7.0%	- 3.1%
INDUSTRIAL PLASTICS PRODUCT-LINE SEGMENT					
Plant Assets @ BV	- 6.7%	- 6.7%	- 6.7%	- 6.7%	- 3.6%
Plant Assets @ Cost.	- 5.2%	- 5.2%	- 5.2%	- 5.2%	- 2.8%
Plant Assets @ BV + WC.	- 0.4%	- 4.1%	- 4.2%	- 4.4%	- 2.4%
Plant Assets @ Cost + WC . . .	- 1.2%	- 3.6%	- 3.7%	- 3.8%	- 2.0%
Total Assets @ BV	- 1.5%	- 3.0%	- 3.1%	- 3.2%	- 1.7%
Total Assets @ Cost.	- 1.6%	- 2.7%	- 2.7%	- 2.8%	- 1.5%
INDUSTRIAL CHEMICALS PRODUCT-LINE SEGMENT					
Plant Assets @ BV	-42.4%	-42.4%	-42.4%	-42.4%	-19.4%
Plant Assets @ Cost.	-21.2%	-21.2%	-21.2%	-21.2%	- 9.7%
Plant Assets @ BV + WC.	-15.9%	-19.9%	-21.0%	-22.0%	- 9.9%
Plant Assets @ Cost + WC . . .	-12.3%	-13.8%	-14.2%	-14.5%	- 6.6%
Total Assets @ BV	-13.7%	-15.8%	-16.5%	-16.9%	- 7.7%
Total Assets @ Cost.	-10.6%	-11.6%	-11.9%	-12.1%	- 5.5%
INDUSTRIAL SYNTHETICS PRODUCT-LINE SEGMENT					
Plant Assets @ BV	-10.5%	-10.5%	-10.5%	-10.5%	- 1.7%
Plant Assets @ Cost.	-10.0%	-10.0%	-10.0%	-10.0%	- 1.6%
Plant Assets @ BV + WC.	- 1.6%	- 2.6%	- 2.8%	- 2.9%	- 0.1%
Plant Assets @ Cost + WC . . .	- 1.6%	- 2.6%	- 2.7%	- 2.9%	- 0.1%
Total Assets @ BV	- 1.6%	- 2.3%	- 2.4%	- 2.5%	- 0.1%
Total Assets @ Cost.	- 1.6%	- 2.3%	- 2.4%	- 2.4%	- 0.1%

SOURCE: Corporation participating in sensitivity study.

sensitive to the youngest. The latter effect holds true despite the fact that the dollar valuation change for plastics and synthetics is the same. The reason for this differentiation in rate sensitivity is that the the larger quantity of inventory in the synthetics (as opposed to plastics) sector is better able to absorb the impact of the overall valuation rate change. Finally, although ROI is decreased and thus understated in the year of F.I.F.O. to L.I.F.O. change, in subsequent years ROI will be increased and therefore overstated because the change in inventory value tends to be more permanent than the change in segmental profit.

Current Asset Additions

In certain instances it may be necessary to add "externally missing" assets to the current asset segment base in order for this base to be realistically representative of all controllable resources. The most notable of these externally nonrecognized resources are those that emerge from intersegmental transactions. The influence of internal exchanges on the investment base is reflected in both the buying segment's inventory and the selling segment's cash or accounts receivable. This need for adding the effect of internal transfers to the segment's investment base arises when:

1. The transfer price used in the exchange is determined by the segments involved instead of being dictated

by central management, and

2. Both the buying and selling segments are completely free to deal with either internal or external markets.

In otherwords, although an internal pricing system is required whenever a firm having internal transactions decentralizes profit responsibility, the result of a transfer is not necessarily included in either the segment's investment base or profit derivation unless the above two prerequisite conditions are also satisfied. The extent to which internal pricing systems are employed in the firms surveyed is shown in TABLE 19 (page 122). This table shows that 92 percent of the firms which decentralize investment center responsibility utilize some form of transfer pricing system. In determining the appropriateness of various pricing systems in segmental managerial evaluation, a prime consideration involves "fairness" of the transfer price to both the transferor and transferee. In addition, the pricing system utilized must support the overall control system by maintaining consistency in managerial decision actions between investment center and corporate interests. With respect to the latter point, Solomons defines the theoretically correct transfer price as the price that enables "the activities of two segments (transferor and transferee) taken together to be the same as if they had been jointly organized as a single investment center."[46]

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[46]Solomons, op. cit., p. 192.

TABLE 19

ANALYSIS OF SEGMENTAL INVENTORY TRANSFER PRICES

NATURE OF TRANSFER PRICE	TRANSFER BASIS		TOTAL FIRMS 100%
	TOTAL FIRMS	PERCENTAGE OF TOTAL	
Transfer pricing not applicable.	17	8%	215
Negotiated prices.	71	33%	
Marginal cost.	4	2%	
Standard marginal cost	11	5%	
Standard cost plus fixed percent markup	41	19%	
Actual cost plus fixed percent markup	13	6%	
Market selling price	52	24%	
Price set by central management.	4	2%	
Other methods**.	26	12%	
Total Response to Inquiry. . . .	239*	111%*	215

SOURCE: Corporations responding to questionnaire.

*Response percentage exceeds 100% because 20 out of 215 firms gave multiple answers to this inquiry.

**Other methods mentioned include the following with the degree of frequency in parentheses: Actual cost with no markup (5), standard cost plus variable markup (7), standard cost (5), market selling price less negotiated discount for expenses avoided by selling internally (9).

In viewing TABLE 19, to what extent does the pricing methods shown satisfy both the two prerequisites cited earlier and Solomons theoretical premise? It would appear that all the cost-based systems fail in both respects because of their following characteristics:

1. All cost-based transfer prices are to some degree authoritarian in nature, and

2. Product costing, especially if the results are also applied in external reporting, is not concerned with the "motivational" aspects of pricing which are so important to internal decision optimization. In most cases, cost-based systems provide negative incentive, or at best no incentive, for cost reduction on the part of the supplying investment center (i.e., full cost pricing and marginal cost pricing).

Relative to the above, TABLE 19 shows that approximately 35 percent of the responding firms apply some form of cost-oriented transfer price in their internal transactions. At the same time, it is encouraging to note that another 60 percent of the responding firms use the following methods of internal pricing, all of which tend to be more conducive to fulfilling both the prerequisite conditions cited on page 120 and Solomons' theoretical premise.

Market based transfer pricing. This form of pricing is used by 24 percent of the responding firms and considers the external market in arriving at a transfer price

for internal purposes. In using market prices, the obvious primary prerequisite is that an external market exist, otherwise the resulting price is arbitrary. Pricing intermediate goods according to market prices has the advantage of motivating the supplying investment center to reduce its production cost as much as possible. In addition, market prices serve to simulate the real conditions to which segments would be exposed if they were organized as separate corporate entities. Finally, use of this form of transfer pricing should align segment and corporate interests. This latter effect will occur in cases where:[47]

1. Transfers must be made if they increase the profit of the corporation as a whole, and

2. Transfers must not be forced upon investment centers if they reduce the profit of the firm.

In both of the above cases, whatever increases the profit of an investment center will also increase the profit of the entire firm. However, if these conditions are to be met, the investment centers must be autonomous and have access to well-developed external markets. To illustrate application of the above segmental and corporate congruency, consider the following:

> From the point of view of the buyer, if the price he must pay is the same for inside and outside

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[47]Paul W. Cook, Jr., "Decentralization and the Trans-Pricing Problem," Journal of Business, April, 1955, p. 87.

> purchases, he cannot be forced to accept a transfer which would result in lower profits than he could earn by purchasing externally. He will accept internal transfers so long as he can profitably use the goods. Thus, any transfer which increases his profit will be made. Considering the same transaction from the standpoint of the seller, if he can get the same price by selling to another internal segment that he can get by selling externally, his profit cannot be reduced by making the transfer internally.[48]

Negotiation based transfer pricing. In the absence of an easily determinable transfer market price, negotiated prices often emerge. This form of transfer pricing, used by 33 percent of the responding firms, involves a mutual agreement between the transferor and transferee as to what constitutes a fair and reasonable transfer price. However, if outside market references do not actually exist, a situation called bilateral monopoly occurs. This situation arises when the bargaining range is extremely wide and the resulting transfer price tends to indicate nothing more than who is the more forceful bargainer. Moreover, in a bilateral monopoly situation, the segments either transfer their goods and services internally or they simply do not transfer. In all other cases where negotiation is applied, the primary advantages to its utilization are that the process involved preserves the independence of the segment managers and serves to guide the segment manager in his purchasing and marketing decisions.

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[48]Ibid.

Combination of market and negotiated prices. This pricing method, which is utilized by 3 percent of the responding firms, involves a negotiated adjustment of the external market price in order to reflect the supplier's savings in distribution, credit, collection, and other expenses by selling internally. These savings allow room for a downward negotiated adjustment of the prevailing external price. It should be noted that the inclusion of this method is low probably because the questionnaire did not show this pricing method choice.

In summary, intersegmental pricing is a means to an end, not an end in itself. It is essential to any decentralized profit control system where segments buy and sell internally. It is obvious that no one method of transfer pricing can fulfill all of the needs of a corporation, but in view of specified goals, certain transfer prices are better than others. It would appear from the foregoing discussion that the cost-based pricing systems are better adapted to the needs of general financial accounting than they are to the needs of segmental performance evaluation.

Current Asset Deletions

With the exception of cash, receivables, and inventory, most other current assets appearing on a segment's balance sheet are not considered in arriving at the segment manager's investment base. A prime example is marketable securities--a nonoperating revenue generator. Naturally, to

maintain consistency, the interest factor is also eliminated from segmental profit.

PLANT ASSET COMPONENT OF THE INVESTMENT BASE

To what extent can the investment in fixed assets be regarded as controllable from the segment manager's point of view? The answer to this question depends on the degree of autonomy which the segment manager enjoys relative to asset acqusition, utilization, and disposal. As shown in TABLE 20 (page 128), the responding firms indicate that the inclusion of plant assets in the manager's investment base is dictated more by the relationship of an asset to a particular segment than by managerial control over the asset in question. This is evidenced by the fact that assets used by multiple segments and assets used by corporate headquarters only are both included in the investment base by many firms; however, the more indirect the asset-to-segment relationship, the lower is the percentage response of base inclusion. As such, plant assets used by one segment only are included in the base by 98 percent of the responding firms while plant assets used by corporate headquarters are included in the base by only 22 percent of these same firms.

TABLE 20 also reveals that 83 percent of the responding firms use net book value while the other 17 percent use gross book value (i.e., original asset cost) to value assets included in the investment base.

TABLE 20

ANALYSIS OF SEGMENTAL INVESTMENT BASE:
PLANT ASSET SECTION

QUESTIONNAIRE INQUIRY AND ASSET BASE RESPONSE	PLANT ASSET PORTION OF INVESTMENT BASE						TOTAL FIRMS 100%
	NOT APPLICABLE		NO		YES		
	TOTAL FIRMS	PERCENTAGE OF TOTAL	TOTAL FIRMS	PERCENTAGE OF TOTAL	TOTAL FIRMS	PERCENTAGE OF TOTAL	
Are plant assets included in the segment base if used:							
By one segment only?			4	2%	211	98%	
By two or more segments?	49	23%	49	23%	117	54%	
By both segment(s) and corporate headquarters?	51	24%	82	38%	82	38%	
By headquarters only?	15	7%	153	71%	47	22%	
Are the following methods used to value plant assets (other than land) in the investment base?							215
Gross book value (cost)			178	83%	37	17%	
Net book value			37	17%	178	83%	
Current replacement cost			215	100%			
Market or appraisal value			215	100%			
Other basis for valuation			215	100%			
If net book value applies, is the same of depreciation used internally as is used for external reporting purposes?			9	5%	169	95%	178

SOURCE: Corporations responding to questionnaire.

Valuation of Included Plant Assets

If all plant assets were purchased at the beginning and retired at the end of the performance evaluation period the problems in valuation would not exist. Obviously, this is not the case and valuation difficulties relative to plant assets do exist. The primary problem in determining what value to use is that neither gross cost nor net book value have any necessary relationship to the asset's operating efficiency value. In addition, both of these valuation methods may contribute to managerial actions that are not conducive to the interest of the overall corporation. A closer examination of each valuation method follows:

Net book value. Net book value is probably so widely used in valuing fixed assets in the base because it is a readily available figure in the conventional accounting records. Most likely this factor also explains why (as shown in TABLE 20) 95 percent of the responding firms utilizing net book value apply the same methods of depreciation in internal performance evaluation as they do in external financial reporting. As such, procedures based on generally accepted accounting principles tend to govern, or at least significantly influence, the derivation of both the segment manager's profit and investment base. The significance of this finding stems from the fact that the resulting ROI and residual income calculations may be

seriously distorted and thus, inaccurately reflect managerial performance. In addition, opportunities for segmental suboptimization once again emerge. The following discussion is designed to provide evidence relative to the points noted above:

The use of a net book value which incorporates conventional depreciation methods can result in the following dysfunctional ROI and residual income effects:

1. ROI and residual income will both automatically increase simply through the passage of time. This occurs because as plant assets age, net book value declines. The overall effect is aggravated if declining balance methods of depreciation are used because not only will the asset base decrease at a faster rate, but profits will also increase due to the lower depreciation in later years.

2. Assuming the above example applies to one plant asset in isolation, what would be the effect if a segment has two identical machines: One recently purchased while the other is one-half depreciated? The overall effect is that both ROI and residual income will be twice as high for the older machine as they are for the newer one. This result is illogical if one is attempting to measure managerial efficiency in operations.

In summary, managerial operating results should not be distorted by the age of an asset except to the extent that asset age affects the operating efficiency of the

resource through poorer performance or higher maintenance costs. In such situations, a lower ROI and residual income should result as the asset becomes older. In this respect, none of the depreciation methods generally acceptable in external financial reporting are adapted to meet this measurement need.

Several examples are now cited in order to show how net book value can also lead to suboptimal segment manager decision action:

1. Utilizing net book value, it is possible to achieve an ROI of infinity if assets become fully depreciated but are still capable of producing an adequate income.[49] Thus, since both ROI and residual income increase as assets become older, new investment and, therefore, corporate growth tend to be discouraged. The use of residual income, however, partially resolves this difficulty by encouraging new investment if its expected return exceeds its charging rate; but the fact still remains that net book value weakens this motivation regardless of the measurement tool that is applied.

2. An advantage frequently cited for the use of net book value is that double counting in the investment base is avoided. Double counting would otherwise result because it is assumed that the portion of original cost represented

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[49]Mauriel and Anthony, op. cit., p. 103.

by depreciation writeoffs is subsequently reinvested in other assets by the segment manager and, therefore, is included in his base in this alternative form.[50] Even if this assertion is valid, there is nothing to motivate the segment manager in the direction of reinvesting funds generated through depreciation. FIGURE 7 (page 133) illustrates this point by comparing two cases where control of depreciation funds is vested in the segment manager. In the first case, management reinvests these funds at an annual rate of 10 percent while in the second case these funds are held in the segment as cash reserves, which results in a reinvestment rate of zero. In both cases, a constant annual earnings rate of 10 percent is assumed for the plant asset held throughout the five-year period. FIGURE 7 points out the fact that although there is some motivation for the segment manager to reinvest funds (Case 1), he is not actually penalized if he fails to do so (Case 2). Such a behavioral reaction is clearly dysfunctional from an overall corporate viewpoint.

3. Finally, when unit (as opposed to composite) depreciation is applied, an additional suboptimal effect may be the premature disposal of productive plant assets in years when these assets are idle or when their return rate is less than satisfactory in the short run.

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[50]Harold R. Lammie, "Return on Capital Employed," The Journal of Accountancy, 106 (August, 1958), 36.

Year Ending	1	2	3	4	5
Net Asset Value	$ 800	$ 600	$ 400	$ 200	$ 0
+ Accumulated Depreciation	200	400	600	800	1,000
Total Asset Cost	$1,000	$1,000	$1,000	$1,000	$1,000

CASE 1: DEPRECIATION FUNDS REINVESTED AT 10%

Orig. Asset Income	$ 100	$ 100	$ 100	$ 100	$ 100
+ Depreciation Reinvestment Earnings	20	40	60	80	100
Total Income	$ 120	$ 140	$ 160	$ 180	$ 200
ROI	12%	14%	16%	18%	20%

CASE 2: DEPRECIATION FUNDS HELD AS CASH RESERVES AT 0%

Orig. Asset Income	$ 100	$ 100	$ 100	$ 100	$ 100
+ Depreciation Reinvestment Earnings					
Total Income	$ 100	$ 100	$ 100	$ 100	$ 100
ROI	10%	10%	10%	10%	10%

FIGURE 7

MANAGERIAL REINVESTMENT DECISIONS AND ROI UNDER NET BOOK VALUE

SOURCE: Terborgh, op. cit., pp. 44-45.

Gross asset cost. The most impressive argument for the use of gross cost is that it eliminates the effects of imperfect depreciation methods from the investment base. However, some authors would argue that this also results in double counting the assets included in the investment base due to the reinvestment of recovered depreciation.[51] When reinvestment does occur gross cost, unlike net book value, will tend to encourage the segment manager to undertake the most profitable reinvestment opportunity. To illustrate the effect of this change FIGURE 8 (page 135) restates, with proper adjustment, the two cases previously presented in FIGURE 7 (page 133), using gross book value. FIGURE 8, Case 1 clearly shows that if the reinvestment rate equals the original earnings rate (i.e., both equal 10 percent), ROI will remain constant. This effect differs from the results shown in FIGURE 7, Case 1 where ROI increased but the reinvestment rate was no more profitable than the original earnings rate. FIGURE 8, Case 2 unlike Case 2 in FIGURE 7 shows that unprofitable holding of cash reserves is penalized using gross book valuation. Therefore, the use of gross cost (as opposed to net book value) will result in the manager's real operating performance being properly shown rather than being overstated. Unfortunately, as is the case with net book value, the opportunity for

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[51] I. Wayne Keller, "The Return on Capital Concept," N.A.A. Bulletin, 39 (March, 1958), 16.

Year Ending	1	2	3	4	5
Gross Asset Cost	$1,000	$1,000	$1,000	$1,000	$1,000
+ Accumulated Depreciation	200	400	600	800	1,000
Total Gross Assets	$1,200	$1,400	$1,600	$1,800	$2,000
CASE 1: DEPRECIATION FUNDS REINVESTED AT 10%					
Orig. Asset Income	$ 100	$ 100	$ 100	$ 100	$ 100
+ Depreciation Reinvestment Earnings	20	40	60	80	100
Total Income	$ 120	$ 140	$ 160	$ 180	$ 200
ROI	10%	10%	10%	10%	10%
CASE 2: DEPRECIATION FUNDS HELD AS CASH RESERVES AT 0%					
Orig. Asset Income	$ 100	$ 100	$ 100	$ 100	$ 100
+ Depreciation Reinvestment Earnings					
Total Income	$ 100	$ 100	$ 100	$ 100	$ 100
ROI	8%	7%	6%	5½%	5%

FIGURE 8

MANAGERIAL REINVESTMENT DECISIONS AND ROI UNDER GROSS BOOK VALUE

SOURCE: Terborgh, ibid., p. 46.

corporate suboptimization can still arise. This situation occurs because by utilizing gross cost valuation:

1. It is possible for a segment manager to increase both his ROI and residual income by scrapping perfectly useful assets (the investment base is reduced by the asset's cost), and

2. In the case of asset replacements, gross cost valuation causes an inconsistent reaction between segment and corporate results. This inconsistency arises because when assets are replaced, gross cost in the segment base will increase by the difference between the original cost of the old and the acqusition cost of the new assets. This reaction is in contrast to the corporate change in that the replacement cost to the firm is equal to the cost of the new asset less the salvage value of the old asset. Furthermore, salvage value is generally far lower than the original cost of the old asset, and suboptimization occurs when segment replacements below the overall corporate earnings rate improves the segment manager's rate of return.[52]

In order to test the sensitivity of the ROI parameter values in TABLE 16 (page 107) regarding plant asset replacement decisions, the following two situations were adapted to the firm participating in the sensitivity analysis used in this study:

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[52]Anthony, Dearden, and Vancil, op. cit., p. 340 and Dearden, "Case Against ROI Control," op. cit., p. 127.

In the first test, it was assumed that $952,000 in obsolete depreciable plant assets were replaced in each product-line segment during 1974 at an average replacement cost of 20 percent above the assets' original acqusition costs. In the net book value ROI calculations, the accumulated depreciation on the assets to be replaced was assumed to approach the average depreciation of all assets in each product-line segment (i.e., plastics 21½%, chemicals 50%, and synthetics 5%). To the industrial product group as a whole, then, the total cost of the assets to be replaced was $2,856,000 (i.e., $952,000 x 3).

The second test was similar to the above except that in each product-line segment 42 percent of the depreciable plant assets were obsolete and required replacement. Therefore, the original cost of assets to be replaced in each product-line segment amounted to:

Plastics	= $ 798,000
Chemicals	= 1,638,000
Synthetics	= 420,000
Total Product-Group	= $2,856,000

All other factors previously assumed with respect to the first replacement test remained the same for purposes of this second test.

The results of the above two tests are shown in TABLES 21 and 22 (pages 138 and 139). As indicated by a comparative analysis of these two tables, the following relationships emerge:

1. With uniform dollar replacement, the synthetics sector ROI results are the most sensitive while the chemicals sector ROI results are the least affected. The reason for this overall reaction is that in the synthetics area, virtually all of its plant assets are replaced while in the chemicals sector, only one-third of its assets are affected. However, when this comparison is based on the sensitivity of ROI between book-value-based ROI and

TABLE 21

SENSITIVITY OF ROI ASSUMING UNIFORM DOLLAR PLANT ASSET REPLACEMENT

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	INCOME BEFORE TAXES	INCOME AFTER TAXES
INDUSTRIAL PRODUCT-GROUP INVESTMENT CENTERS					
Plant Assets @ BV	-23.1%	-12.9%	-11.7%	-10.4%	-5.3%
Plant Assets @ Cost.	- 5.1%	- 2.8%	- 2.6%	- 2.3%	-1.2%
Plant Assets @ BV + WC.	- 8.3%	- 4.6%	- 4.2%	- 3.7%	-1.9%
Plant Assets @ Cost + WC . . .	- 2.3%	- 1.3%	- 1.2%	- 1.0%	-0.5%
Total Assets @ BV	- 4.8%	- 2.6%	- 2.4%	- 2.1%	-1.1%
Total Assets @ Cost.	- 1.5%	- 0.8%	- 0.7%	- 0.6%	-0.3%
INDUSTRIAL PLASTICS PRODUCT-LINE SEGMENT					
Plant Assets @ BV	-22.4%	- 8.0%	- 7.7%	- 7.0%	-3.9%
Plant Assets @ Cost.	- 7.5%	- 2.7%	- 2.6%	- 2.3%	-1.2%
Plant Assets @ BV + WC.	-17.6%	- 6.3%	- 6.1%	- 5.5%	-3.0%
Plant Assets @ Cost + WC . . .	- 6.1%	- 2.2%	- 2.1%	- 1.9%	-1.0%
Total Assets @ BV	- 7.7%	- 2.8%	- 2.6%	- 2.4%	-1.3%
Total Assets @ Cost.	- 3.0%	- 1.0%	- 1.0%	- 0.9%	-0.5%
INDUSTRIAL CHEMICALS PRODUCT-LINE SEGMENT					
Plant Assets @ BV	-22.2%	-16.3%	-14.6%	-13.3%	-6.3%
Plant Assets @ Cost.	- 2.0%	- 1.5%	- 1.3%	- 1.2%	-0.5%
Plant Assets @ BV + WC.	- 7.7%	- 5.7%	- 5.1%	- 4.6%	-2.2%
Plant Assets @ Cost + WC . . .	- 1.0%	- 0.7%	- 0.6%	- 0.6%	-0.3%
Total Assets @ BV	- 4.6%	- 3.4%	- 3.0%	- 2.7%	-1.3%
Total Assets @ Cost.	- 0.7%	- 0.5%	- 0.4%	- 0.4%	-0.2%
INDUSTRIAL SYNTHETICS PRODUCT-LINE SEGMENT					
Plant Assets @ BV	-32.2%	-17.8%	-16.7%	-13.8%	-7.1%
Plant Assets @ Cost.	-24.3%	-13.5%	-11.9%	-10.5%	-5.4%
Plant Assets @ BV + WC.	- 4.7%	- 2.6%	- 2.3%	- 2.0%	-1.0%
Plant Assets @ Cost + WC . . .	- 3.7%	- 2.0%	- 1.8%	- 1.6%	-0.8%
Total Assets @ BV	- 3.1%	- 1.7%	- 1.5%	- 1.3%	-0.6%
Total Assets @ Cost.	- 2.4%	- 1.3%	- 1.2%	- 1.0%	-0.5%

SOURCE: Corporation participating in sensitivity study.

TABLE 22

SENSITIVITY OF ROI ASSUMING UNIFORM PERCENTAGE PLANT ASSET REPLACEMENT

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	INCOME BEFORE TAXES	INCOME AFTER TAXES
INDUSTRIAL PRODUCT-GROUP INVESTMENT CENTERS					
Plant Assets @ BV	-26.8%	-14.9%	-13.4%	-12.1%	-6.2%
Plant Assets @ Cost.	- 5.1%	- 2.9%	- 2.6%	- 2.3%	-1.2%
Plant Assets @ BV + WC.	- 9.8%	- 5.5%	- 5.0%	- 4.4%	-2.2%
Plant Assets @ Cost + WC . . .	- 2.3%	- 1.3%	- 1.2%	- 1.1%	-0.5%
Total Assets @ BV	- 5.7%	- 3.2%	- 2.8%	- 2.6%	-1.3%
Total Assets @ Cost.	- 1.5%	- 0.8%	- 0.7%	- 0.6%	-0.3%
INDUSTRIAL PLASTICS PRODUCT-LINE SEGMENT					
Plant Assets @ BV	-19.5%	- 7.0%	- 6.7%	- 6.0%	-3.4%
Plant Assets @ Cost.	- 6.4%	- 2.3%	- 2.2%	- 2.0%	-1.1%
Plant Assets @ BV + WC.	-15.3%	- 5.5%	- 5.3%	- 4.7%	-2.6%
Plant Assets @ Cost + WC . . .	- 5.2%	- 1.9%	- 1.8%	- 1.6%	-0.9%
Total Assets @ BV	- 6.6%	- 2.4%	- 2.3%	- 2.0%	-1.1%
Total Assets @ Cost.	- 2.5%	- 0.9%	- 0.8%	- 0.8%	-0.4%
INDUSTRIAL CHEMICALS PRODUCT-LINE SEGMENT					
Plant Assets @ BV	-32.3%	-23.7%	-21.3%	-19.3%	-9.2%
Plant Assets @ Cost.	- 3.4%	- 2.5%	- 2.2%	- 2.0%	-0.9%
Plant Assets @ BV + WC.	-12.0%	- 8.8%	- 7.9%	- 7.2%	-3.4%
Plant Assets @ Cost + WC . . .	- 1.7%	- 1.3%	- 1.1%	- 1.0%	-0.5%
Total Assets @ BV	- 7.3%	- 5.3%	- 4.8%	- 4.3%	-2.1%
Total Assets @ Cost.	- 1.2%	- 0.9%	- 0.8%	- 0.7%	-0.3%
INDUSTRIAL SYNTHETICS PRODUCT-LINE SEGMENT					
Plant Assets @ BV	-15.7%	- 8.7%	- 8.6%	- 6.7%	-3.5%
Plant Assets @ Cost.	-11.5%	- 6.4%	- 5.6%	- 5.0%	-2.5%
Plant Assets @ BV + WC.	- 2.1%	- 1.2%	- 1.1%	- 0.9%	-0.4%
Plant Assets @ Cost + WC . . .	- 1.6%	- 0.9%	- 0.8%	- 0.7%	-0.3%
Total Assets @ BV	- 1.4%	- 0.7%	- 0.6%	- 0.6%	-0.3%
Total Assets @ Cost.	- 1.0%	- 0.6%	- 0.5%	- 0.4%	-0.2%

SOURCE: Corporation participating in sensitivity study.

cost-based ROI, the opposite sensitivity relationship will arise. This latter result occurs because when comparing gross cost and net book value based ROI's, the segment with the oldest assets (chemicals) will experience the greatest increase in its book value base due to the large accumulated depreciation balance that must be relinquished in the replacement process.

2. With uniform percentage replacement, the segment with the lowest amount of plant assets will be the least affected. Therefore, ROI rate sensitivity is greatest in the chemicals segment and lowest in the synthetics segment. This relationship is the same even if the comparison is gross cost versus net book value based ROI's.

3. For the industrial product group as a whole, the ROI's based on gross cost possess the same sensitivity in both the uniform percentage and uniform dollar replacement tests, but these sensitivity rates differ for the net-book-value-based ROI's. In this respect, the sensitivity is greater in the uniform percentage test due to the higher degree of influence of replacements in the chemicals product-line sector. This factor provides further evidence to support the contention that the mere age of assets--as opposed to their relative operating efficiency--affects the sensitivity of a net-book-value-based ROI determination.

Although it has not been illustrated in the above tests, virtually the same dollar results in terms of sensitivity direction would result if residual income

rather than ROI was the tool evaluated. Thus, residual income is no better than ROI in evaluating managerial effectiveness when plant assets at gross or net book value are included in the investment base.

Plant Asset Valuation Adjustments

The inequities caused by gross cost and net book plant asset valuations are reduced by including assets in the segment manager's investment base at replacement cost. Although no firms in the present questionnaire study use this alternative form of valuation, it is a valuation method utilized by some corporations.[53] While this method of valuation provides for the equalization of dollar values, it makes no distinction between older facilities and equipment that may be less efficient in segmental operations.

Plant Asset Additions

In certain cases, the plant asset base must be modified by adding "missing assets" in order for the results to reflect total controllable operating resources. Accordingly, a distorted and unrealistic ROI and residual income will result if plant assets are leased instead of owned by the

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[53]National Association of Accountants Research Report Number 35, op. cit., p. 11.

This study indicated that 2 out of 42 companies included in its analysis adjusted plant asset valuation to reflect current replacement asset cost.

investment centers. The extent to which performance distortion can occur is demonstrated in the following test situation which was adapted to the corporation participating in the sensitivity analysis:

> It was assumed that the chemicals product-line industrial segment had originally leased instead of purchased 50 percent (i.e., $1,950,000) of its depreciable plant assets at an annual leasing cost of $200,000. The leased assets were not capitalized in the investment base but the annual leasing cost was deducted in profit derivation. The original data presented in TABLES 2 and 3 was adjusted to reflect the above test situation.

The effect of this leasing test on the ROI parameter values shown in TABLE 16 (page 107) is presented in TABLE 23 (page 143). The overall result is a significant increase in both the industrial product group's and chemicals segment's ROI ratios. This effect occurs because leasing is generally less expensive to the segment than outright purchasing of plant asset resources; however, the nearer the leasing interest rate is to the rate of return which the asset is capable of earning in operations, the less difference will the substitution of leased assets for owned assets (or vice versa) make in the derivation of ROI or residual income. To the extent that rate equality does not exist and the investment center manager has the authority to make the lease-or-buy decision, it normally is to his own best interest to lease as much as possible even if from the corporation's view it would be better to buy.[54]

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[54]Mauriel and Anthony, op. cit., p. 104

TABLE 23

SENSITIVITY OF ROI ASSUMING THAT THE CHEMICALS SEGMENT ORIGINALLY LEASED 50 PERCENT OF ITS PLANT ASSETS

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	INCOME BEFORE TAXES	INCOME AFTER TAXES
INDUSTRIAL PRODUCT-GROUP INVESTMENT CENTER					
Plant Assets @ BV. . . .	+28.1%	+12.4%	+10.9%	+ 9.4%	+ 4.7%
Plant Assets @ Cost. . .	+26.5%	+12.4%	+11.0%	+ 9.6%	+ 4.8%
Plant Assets @ BV + WC .	+ 8.2%	+ 2.9%	+ 2.4%	+ 2.0%	+ 1.0%
Plant Assets @ Cost + WC	+10.6%	+ 4.4%	+ 3.9%	+ 3.3%	+ 1.6%
Total Assets @ BV. . . .	+ 4.4%	+ 1.2%	+ 1.0%	+ 0.7%	+ 0.3%
Total Assets @ Cost. . .	+ 6.3%	+ 2.4%	+ 2.1%	+ 1.8%	+ 0.9%
INDUSTRIAL CHEMICALS PRODUCT-LINE SEGMENT					
Plant Assets @ BV. . . .	+87.2%	+51.8%	+45.1%	+39.9%	+18.2%
Plant Assets @ Cost. . .	+43.6%	+25.9%	+22.6%	+19.9%	+ 9.1%
Plant Assets @ BV + WC .	+18.6%	+ 9.1%	+ 7.6%	+ 6.5%	+ 2.7%
Plant Assets @ Cost + WC	+17.4%	+ 9.3%	+ 8.0%	+ 7.0%	+ 3.1%
Total Assets @ BV. . . .	+ 9.8%	+ 3.9%	+ 3.1%	+ 2.5%	+ 1.0%
Total Assets @ Cost. . .	+10.8%	+ 5.4%	+ 4.5%	+ 3.9%	+ 1.7%

SOURCE: Corporation participating in sensitivity analysis.

As such, an additional opportunity for corporate suboptimization can arise in the case of noncapitalized long-term leasing arrangements.

The extent to which the corporations responding to the questionnaire include leased assets in segmental base determination is shown in TABLE 24 (page 145). In a comparison between external and internal leasing sources, an interesting fact is revealed, namely, that many firms leasing from both internal and external sources include only the effects of external leases as capitalized in the base. Possibly this inconsistency can be explained by noting that generally accepted accounting principles presently require that leased assets be construed as owned (or purchased) resources, and thus subject to capitalization, where the leasing arrangement is long term in nature. This requirement, however, does not extend to internal leasing sources, as these internal effects would be eliminated in the determination of corporate consolidated totals. The position taken in this study is that leasing source is immaterial, and if the lease-or-buy decision is controllable by the segment manager, long-term leased resources should be capitalized in the investment base. The following serves to justify this need for inclusion of controllable leased resources in the asset base:

> If one is evaluating the operating efficiency of two segment managers and one manager purchases his equipment while the other manager leases the same identical equipment, then the same operating rate of

TABLE 24

ANALYSIS OF SEGMENTAL INVESTMENT BASE:
ROLE OF LEASED ASSETS

QUESTIONNAIRE INQUIRY AND LEASED ASSETS RESPONSE	LEASED ASSETS						TOTAL FIRMS 100%
	NOT APPLICABLE		NO		YES		
	TOTAL FIRMS	PERCENTAGE OF TOTAL	TOTAL FIRMS	PERCENTAGE OF TOTAL	TOTAL FIRMS	PERCENTAGE OF TOTAL	
Are leased assets included in a segment's resource base if they are:							
Leased from other segments within the firm?	103	48%	90	42%	22	10%	215
Leased from other firms? .	24	11%	123	57%	68	32%	
Valuation in base of included leased assets:							
Capitalized value of leasehold.					36	47%	77*
Estimated Original cost or similar measure.					12	16%	
Net book value.					26	34%	
As a specific multiple of annual leasing cost					2	2%	
Net present value					1	1%	
Total Response to Leasing Base Inclusion.					77	100%	77

SOURCE: Corporations responding to questionnaire.

*Out of 215 firms, 25 firms lease from both internal and external sources; however, only 13 out of these 25 firms include the effects of both types of leasing in a segment's base, while the other 12 firms include in the base external leases only. Therefore, 77 firms include some form of leased assets in a segment's resource base (77 = 90 - 13).

> return or residual income should be expected, all other performance factors being equal. However, if the leased equipment is not capitalized, quite divergent performance results will emerge. To eliminate the possibility of this distortion occurring, both assets should be considered as identical. This requires that the leased equipment be included in the investment base as an employed asset resource.[55]

With respect to the valuation base of capitalized leased assets, TABLE 24 shows the valuation methods used by the responding corporations. The method of capitalizing the value of the leasing payments--used by 47 percent of these firms--is completely valid only if the period of the lease arrangement is equal to the expected life of the leased asset. All other listed methods are at best mere approximations of this value. It was surprising to note that none of the firms listed asset capitalization by appraisal techniques. Possibly the reason lies in the fact that this choice of capitalization was not listed on the questionnaire.

Plant Asset Deletions

In certain situations, existing plant assets should be omitted from the investment center manager's base calculation. An example is idle assets, where the utilization decision is not subject to the control of the segment manager. However, if the segment manager does control the utilization decision, then idle assets should be included

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[55]Ravenscroft, op. cit., p. 101.

in his investment base, if for no other reason than to provide an incentive for utilization or disposal. Care must be exercised in this case, however, because it might encourage the segment manager to dispose of such assets merely to reduce his investment base.

The inclusion of assets utilized by corporate headquarters and shared facilities in the investment base can also be questioned. In the latter case, if two or more segments share the same facilities and the various segment managers' responsibility and authority is not clearly divisible, then these resources should not enter an individual segment manager's base determination. This contention is contrary to the majority corporate response in TABLE 20 where 54 percent of the firms include shared facilities in a segment manager's investment base. At this point there is no need to rehash the problems incurred in base allocations as the problems experienced parallel those already discussed in Chapter 4.

FINALIZING THE SEGMENT MANAGER'S INVESTMENT BASE: THE ROLE OF LIABILITIES

There appears to be considerable disagreement, as shown in TABLE 25 (page 148), as to whether the segment manager should be evaluated on the sources of assets as well as their usage. This difference of opinion also extends to the literature. In this respect, some authors claim that the segmental investment base should be net of

TABLE 25

ANALYSIS OF SEGMENTAL INVESTMENT BASE:
ROLE OF LIABILITIES

QUESTIONNAIRE INQUIRY AND DEDUCTION RESPONSE	DEDUCTION OF LIABILITIES						TOTAL FIRMS 100%
	YES		NO		NOT APPLICABLE		
	TOTAL FIRMS	PERCENTAGE OF TOTAL	TOTAL FIRMS	PERCENTAGE OF TOTAL	TOTAL FIRMS	PERCENTAGE OF TOTAL	
Are any of the following type of liabilities deducted in finalizing a segment's investment base?							
Current intrafirm payables.	67	31%	133	62%	15	7%	215
Current trade payables. . .	97	45%	112	52%	6	3%	
Other current liabilities .	88	41%	123	57%	4	2%	
Non-current external debt .	41	19%	168	78%	6	3%	

SOURCE: Corporations responding to questionnaire.

all current liabilities.[56] Other writers call for a deduction of interest-free liabilities in order to leave in the base total resources provided specifically in the expectation of earning a monetary return.[57] Still others argue that the deduction of any liability amounts to a confusion between asset usage and financing decisions.[58] The majority opinion of the responding corporations seems to agree with this last contention that liabilities should not be deducted at all in arriving at the resource base total. In essence, the sentiment implied is that the deduction of liabilities destroys the effectiveness of ROI and residual income as performance measures. Furthermore, the assumption is that all assets, regardless of source, should be used with equal effectiveness in the profit earning process. Therefore, it would appear that segment managers are not to be concerned with sources of funds used to acquire segment assets whether these sources consist of equity capital, leasing agreements, or long-and-short term borrowings. In this study, the emphasis is placed on managerial responsibility for all assets under a segment manager's control. As such, the majority corporate opinion regarding the role of liabilities is congruent with the overall contention of

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[56]Solomons, op. cit., pp. 133-134.

[57]Shillinglaw, "Divisionalization, Decentralization and Return on Investment," op. cit., p. 25.

[58]Thomas Casson, "Return on Investment," Financial Executive, 21 (September, 1954), 411.

this study.

SUMMARY

The techniques presently employed by corporations in deriving and valuing the segment manager's investment base tend to confuse controllable and noncontrollable resource components. By so doing, a segment manager's success in economizing a controllable resource may be more than offset by an increase in a noncontrollable element. This effect not only causes frustration and breeds an environment for suboptimal motivation, but it also diminishes the effectiveness of ROI and residual income as managerial performance measures. This dual problem of asset composition and valuation in determining an investment center manager's resource base is probably the source of greatest confusion and controversy both in practice and in the literature on investment centers. Accordingly, the next chapter will recommend feasible methods of resolving some of the difficulties presented in both the current and preceding chapters.

Chapter 6

SUMMARY AND CONCLUSIONS

The objective of this research was to conduct an inquiry into the methods used by industrial corporations in their evaluation of investment center managerial performance, and after completing this inquiry, to recommend improvements in the procedures presently utilized. As such, the dual hypotheses which formed the basis of this study were as follows:

1. The measurement criteria presently used in assessing the effectiveness of investment center managerial performance is influenced too strongly by generally accepted accounting principles to be an internally meaningful evaluation, and

2. Too much reliance on generally accepted accounting principles causes distortions in the evaluative process and may result in misdirected managerial motivation with respect to optimizing total company performance.

CONCLUSIONS

The evidence accumulated in the preceding chapters is sufficient to affirm the general validity of both of the above-stated hypotheses. Definite proof of substantial reliance on externally-oriented accounting principles has

been provided as well as illustrations of both measurement base distortion and suboptimal motivation. A summary of evidence in support of the above is provided in TABLE 26 (pages 153 and 154). In addition to the procedures critically reviewed in this table, corporate insistence on the uniformity and consistent application of these procedures among its internal segments is looked upon unfavorably. One reason is the authoritarian connotation that such a requirement implies, while another more important reason is that such a requirement fails to recognize the uniqueness and heterogeneous nature of the various investment center segments.

While the validity of the hypotheses has, in general, been affirmed, one area of doubt implied in the second hypothesis remains. This unresolved area pertains to the degree of correlation existing, if any, between measurement base distortion and the occurrence of suboptimal motivational actions. On this point, the study has not established a sufficient foundation to prove the existence of such a correlation, though some degree of cause-and-effect is believed to exist. In this study, the only reciprocal relationship that has been affirmed pertains to the distortion and suboptimal opportunities that can arise as a result of using procedures in accordance with externally-oriented measurement principles. These opportunities are often taken advantage of due to the emphasis placed on inappropriate profit goals coupled with the basic unfairness of

TABLE 26

SUMMARY OF EVIDENCE TO SUPPORT RESEARCH CONCLUSION

PROCEDURES USED BY CORPORATIONS	PROCEDURE EFFECTS	
	PERFORMANCE DISTORTION	CORPORATE SUBOPTIMIZATION
Use of before or after tax profits as the profit base:	Improper profit emphasis on long-term performance.	Discourages short-term efficiency because savings in controllable costs may be more than offset by increases in unrelated noncontrollable costs.
Use of "full" costing methodology:	Includes effect of noncontrollable items in profit base derivation.	Absorption costing element of full product costing enables increases in short-term profit by inefficient increases in production nonproportionately over sales.
Use of L.I.F.O. based inventory valuation:	Reflects misleading inventory value and allows short-term profit manipulation by varying end-of-period purchases.	Encourages inefficient retention of low L.I.F.O. cost-valued inventory.
Significant use of intersegment transfer prices:	Weakens and distorts profit as a performance measure because profit becomes dependent on the transfer price.	Cost-based transfer prices discourage supplying segment cost efficiency motivation. Also, profits of one segment may increase to the detriment of the corporation as a whole.
Allocation of shared assets and central facilities:	Includes effect of noncontrollable assets in the investment base.	If based on sales or gross profit, a manager may restrict sales to avoid a more-than-proportional cost allocation.

Emphasis on the use of net book valuation and external methods of depreciation:	Net book valuation increases performance as assets become less efficient and also fails to represent either asset cost or present value in base; external depreciation methods overstate profit as assets age, especially if declining balance methods are used.	Discourages new investment and segment growth and may encourage premature disposal of productive resources in idle periods. Net book value also fails to motivate profitable reinvestment of funds generated through depreciation.
Use of gross cost base valuation as an alternative to net book value:	Can result in double counting in the resource base.	Encourages the disposal of idle assets and causes inconsistent performance results in replacement decisions. In the latter case, replacements below the corporate minimum return rate may improve a segment manager's return performance.
Failure to include the effect of all leased assets in base:	Understates investment base and overstates performance.	Because leasing is less expensive than outright purchase of an asset, segment management will lease as often as possible. This action may be to the long-term detriment of the corporation as a whole.

SOURCE: Chapters 4 and 5 in this study.

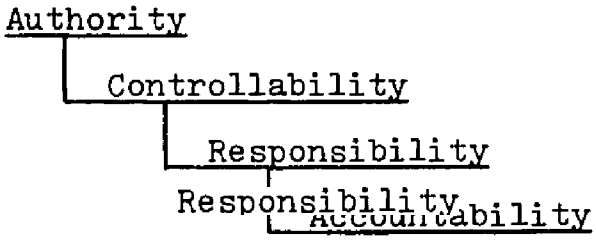
the resulting tool measures.

RECOMMENDATIONS

As a result of this research inquiry, the following improvements in measurement procedure are recommended. The purpose of these recommendations is to resolve most of the problems cited in this study as well as to provide a fair and effective base for managerial performance assessment.

Internal Measurement System

The internal measurement system should consider the following operating-responsibility framework in seeking to evaluate managerial segments:



This framework emphasizes that:

1. Adequate decision authority is the key to resource controllability,

2. Responsibility exists only for resources over which the segment manager exercises substantial control, and

3. The segment manager is to be held accountable in terms of performance effectiveness for all elements over which he exercises divisible responsibility.

With respect to the area of performance accountability,

the establishment of internal measurement standards is essential, and the following guidelines, through not intended to comprise an all-inclusive list, are recommended for consideration:

Relevance. The concept of relevance should provide the cornerstone in constructing internal measurement guidelines because relevance implies that an immediate distinction be drawn between the information needs of the users involved, whether these users are internal or external. In addition, the relevance concept emphasizes the adaptation of accounting procedures within a segment based on the segment's uniqueness and heterogeneous nature, as opposed to procedural use being governed by the external standards of consistency and uniformity.

Operational Independence. Segmental operating independence will help to assure a minimum of segmental performance interdependence, and thus, will aid the cause of assuring divisible responsibility among internal entities.

Co-Variability and Congruency. Co-variability requires that the income measured for a segment correspond in direction to the overall change in the segment's contribution to total company profit. Congruency extends this guideline to include the proper coordination of segmental and corporate interests in all respects. Both guidelines imply the use of unbiased measurement procedures as well as the establishment of coordinated target goals among the segments.

The above guideline considerations emphasize that the evaluative needs of internal and external users differ, and this difference can be attributed to the desire for internal performance segmentation. As such, the standards adapted internally should obviously differ to some degree from those guidelines sanctioned by externally-oriented accounting principles. Due to the multiple dimension of internal (as opposed to external) information needs, the internal standards must be loosely established and allow sufficient latitude for procedural differentiation. The guidelines suggested for consideration in the above section possess the characteristic of versatility and at the same time, aid in the maximization of integrated segmental control--a vital goal in today's complex organizations.

Use of ROI and Residual Income

Due to the potential conflict in performance results that can emerge between ratio (relative) and dollar (absolute) returns, a distinction in tool utilization is essential. In this respect, the use of return on investment is most appropriate in situations where the segment manager exercises control over revenues, expenses and asset utilization only. In essence, he possesses little control over the level of segment investment which implies that he is not significantly involved in resource replacement, reinvestment, or disposal decisions. Thus, if the level of his investment base is relatively fixed over the short run,

the idea of "controllable investment" is meaningless. In otherwords, if resource composition decisions lie outside the segment manager's domain of control, the investment base should be defined as "total resources employed in operations" instead of the "controllable resources employed" definition previously suggested in Chapter 5. Additionally, in this situation, the use of ROI will not yield conflicting performance results with the alternative measure of residual income because in the short-term time frame, the investment base is of a fixed magnitude. As such, the maximization of ROI also simultaneously maximizes absolute dollar profit. Although the situation outlined above does not represent the decision authority that should be possessed by a "real" investment center manager, it would appear that some industrial corporations interpret the extent of investment center decision autonomy in exactly this way.[59] In otherwords, the investment center responsibility concept is sometimes misused in situations disguised by profit center authority.

Based on the foregoing, then, the use of residual income is reserved for segment managers who possess the decision discretion intended by the investment center responsibility concept--to exercise substantial control over the scale of operations. Included within a segment manager's authority, then, is the ability to influence replacement,

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[59]An opinion derived from observation of the questionnaire responses regarding resources included in a segment manager's investment base.

reinvestment, and disposal of resources as well as to control their utilization.

In summary, the above recommended distinction in tool utilization stems from the fact that if segment management can significantly influence the size and composition of the segment investment base, then return on investment is greatly weakened as a measure of managerial performance effectiveness.

Profit Base Derivation

In the calculation of segmental profit for ROI and residual income, how feasible is the construction of this internal profit measure out of the already existing external measurement system? In otherwords, could the external measurement of profit simply be rearranged in order to derive an internal profit base? Profit derivation would be easy if this could be accomplished fairly; however, due to the lack of external system emphasis on divisibility, controllability, and behavioral characteristics of revenues and expenses, a simple rearrangement of external data is not an appropriate solution to the internal measure of profit.

A recommended solution, although not a perfect one, is to improve the present derivation and emphasize the role of "controllable" profit in the short run. As such FIGURE 9 (page 160) illustrates the suggested method of deriving this controllable profit measure for ROI and residual income applications. Emphasis on a controllable profit

	RETURN ON INVESTMENT	RESIDUAL INCOME
Net Sales	$x,xxx	$x,xxx
Less: Controllable variable cost of goods sold	-x,xxx	-x,xxx
Gross Margin	$x,xxx	$x,xxx
Less: Controllable variable market and administration expenses	-x,xxx	-x,xxx
Contribution Margin	$x,xxx	$x,xxx
Less: Fixed expenses directly identifiable with and controllable by the segment manager in the short-run plus depreciation on controllable investment	- xxx	- xxx
Performance (Controllable) Margin for Return on Investment	$x,xxx	$x,xxx
Less: Interest and capital charges on controllable investment base*		- xxx
Performance (Controllable) Margin of Residual Income		$x,xxx

*Different charging rates are applied to different types of assets in the calculation of residual income.

FIGURE 9

RECOMMENDED BASIS FOR PROFIT DERIVATION

base not only eliminates the practical difficulty of cost allocation, but also removes the theoretical objection to the idea that business segment managers are independently capable of earning a profit or sustaining a loss. Furthermore, if multi-period or long-term profit analysis is subsequently desired, the above system is easily adaptable. As such, this long-term controllable profit can be defined as consisting of the performance margin contributions of the shorter periods plus any revenues and minus any expenses which are attached specifically to and are controllable by the segment manager in the evaluation period.

The inclusion of depreciation in the performance margin base derived on the previous page requires explanation, as depreciation is not generally considered to be a controllable expense in the short run. The reason for its inclusion is to reflect the utilization of controllable plant resources during the evaluation period. As such, the method of depreciation selected should reflect the expected increasing loss in asset operational efficiency over time. Because none of the externally-oriented depreciation methods are designed to meet this increasing charge need, the use of an annuity approach to depreciation is recommended. In essence, annuity depreciation represents a compound interest approach to depreciation recognition. FIGURE 10 illustrates the annuity concept by assuming a constant earnings rate of $300, an initial asset cost of $1,000 and a return on this asset of 20 percent:

Year	Profit	-	20% Return	=	Depreciation Recovery	-	B.V. of Beginning Resources	=	B.V. of Ending Resources
0									$1,000
1	$300	-	$200	=	$100	-	$1,000	=	900
2	300	-	180	=	120	-	900	=	780
3	300	-	156	=	144	-	780	=	636
4	300	-	127	=	173	-	636	=	463
5	300	-	93	=	207	-	463	=	256
6	300	-	51	=	249	-	256	=	7*

*If asset is disposed of at the end of year 6, a loss of $7 would be recognized.

FIGURE 10

ANNUITY METHOD DEPRECIATION

If depreciation is determined in this manner, then even if net book valuation is used in the investment base, the overall problem of an increasing ROI or residual income due to the mere passage of time is corrected.

In summary, the basis recommended for profit derivation which includes depreciation on controllable resources but excludes cost allocations and other short-term noncontrollable expenses should provide:

1. A fair basis on which to assess managerial performance effectiveness, and

2. An appropriate profit maximization objective in order mesh segmental and corporate goal congruency.

Investment Base Determination

The objectives of investment base derivation should be to provide a "fair" foundation on which to appraise segment managerial performance and to motivate the segment manager in the direction of formulating decisions congruent with the optimization of corporate interests. The adverse effects (previously discussed in Chapter 5) of utilizing accounting book values in determining segmental resource valuation in the investment base include:

1. Distortion and inconsistent behavior of ROI and residual income,

2. Restraint of new investment and discouragement of segment growth,

3. Lack of proper motivation to reinvest recovered

resource funds profitably,

4. Potential duplication of resources in the investment base, and

5. Disposition of profitable assets prematurely.

It would appear from the foregoing that accounting book values create considerable problems that could be resolved to some extent by using an alternative form of valuation in the base. The recommended solution to this revised valuation is current cost. It should be noted that current, as opposed to either past or future cost, is most relevant because it is present, not previous or forecasted, performance effectiveness that one is attempting to measure. Furthermore, the valuation emphasis is on current entry determinations because the investment base represents the aggregate of controllable "input" resources in both the ROI and residual income calculations. Thus, for purposes of performance measurement, it is the current value of resources put in, rather than the current value of resources that can be removed, which is relevant. The following is a brief outline of how the above current cost approach can be adapted to valuing specific assets in the investment base:

Cash. Assuming cash flows are substantially controllable by the segment manager, the following procedure is recommended: "Normal" cash balances (based on average segment expenditures derived over a representative period

of time) should be "excluded" from base consideration; however, "excessive" cash reserves retained by the segment manager should be "included" at their monetary value equivalent in his base. Under this arrangement, a segment manager should be motivated to transfer idle or excess cash to headquarters and retain only that portion which he thinks he can profitably reinvest. Furthermore, this philosophy encourages responsibility for cash efficiency in the individual segments where it should be rather than at corporate headquarters. The only prerequisite to initiating a system of this type is that corporate headquarters must maintain a separate cash account balance for each internal segment.

Receivables. Assuming that credit and collection control are within the segment manager's authority, receivables should be included in his investment base at their gross monetary value. Furthermore, if the period of evaluation is significantly long, average, not beginning or ending, receivables should be considered in the base. One reason for including average receivables is to minimize a suboptimal situation that can otherwise arise when a last minute effort, regardless of long-term consequences, is made to collect receivables in order to reduce their inclusion in the base. In addition, average balances tend to be more representative of performance throughout a long period than are either beginning or ending balances.

Inventories. As in the case of receivables, if the evaluation period is significant, average, instead of

beginning or ending quantities, should be considered in the base. Valuation of these quantities, however, depends on the following conditions:

1. Inventories manufactured within a segment and not available externally should be included in the base at up-to-date standard costs which, if correctly established, should approximate current reproduction cost.

2. If this manufactured inventory is available externally or if inventory is purchased externally rather than manufactured, then current cost can be directly obtained by using external replacement cost.

3. For inventories acquired by internal transfers from other segments, the transfer price used depends on whether external market sources exist. In the situation where external markets exist, the most appropriate transfer price seems to be the external price less a negotiated discount for expense savings due to the internal nature of the sale. In the buying segment's inventory, this price should come very close to approximating current replacement cost; otherwise, the segment manager would purchase from an external source. This procedure also allows the selling segment manager to show a reasonable profit in his profit base. In the above situation, transfer prices are controlled by the segments involved in the transfer with the external market price being used as an initial guide. In cases where external markets do not exist for goods transferred internally, a problem in resource base valuation as

well as profit determination arises. Where transactions of this type are significant, the best solution is to redefine segmental boundaries by merging the two segments; however, in cases where one segment supplies inventory to a number of other segments, the above solution will not suffice. As an alternative, the supplying segment could be designated as a service center rather than as an investment center. As such, this service segment would have the sole responsibility of serving other segments' needs, but would not have the responsibility of having to earn a profit on these internal transfers. The associated price of these transfers should be up-to-date standard costs. Thus, for internal transfers for which no external markets exist, the price is determined centrally and, consequently, is not within the segment manager's domain of control. In addition, the fact that the supplying segment does not recover all of its actual production costs and earn a profit is not particularly important if its performance classification is no longer within the profit or investment center responsibility framework. The important consideration in this situation is that the buying segment is not forced to absorb any cost inefficiencies in the supplying segment's transfer price.

In summary, the overall recommendation for inventory valuation of items included in the base emphasizes the use of either current reproduction or replacement cost standards. By using an up-to-date standard cost and removing price

variances from the segment manager's profit base, the effect is to provide a meaningful performance index, which measures segmental committment of corporate funds to inventory investment. At the same time this produces a profit base that is free from fluctuations in the prices actually paid for manufacturing resources, since this price element is not generally controllable by the segment manager.

Plant assets. Only plant assets under the control of a single segment should be included in the segment manager's investment base, regardless of whether these assets are purchased or leased by the segment. Thus, plant assets used only by corporate headquarters should not be allocated to the segment manager's base. As for plant assets used by multiple firm segments, no cost allocation should be made. Instead assuming the segment manager controls the utilization rate of shared facilities, as opposed to forced utilization, the most feasible solution is to charge a reasonable rental fee for the extent of services provided to each segment and include this rental fee in the segment manager's profit derivation.

Once controllable plant asset composition has been determined, the question of its valuation arises. Here a number of potential values emerge for a depreciable asset because the asset has one value when it is acquired, a second on the books, a third if replacement is contemplated, a fourth if replacement cost is reduced by the use which has been made of the asset, and a fifth value if the asset

is sold or otherwise disposed of. In this respect, the performance effectiveness results will vary depending on the value used and objections can be raised to the use of any one of these values. Despite the primary objection of subjectivity that is often cited, depreciable assets under the segment manager's control should be included in his base at their current operating value. This value is equal to current cost less depreciation. The method of arriving at this assessment of current cost value may be by direct replacement cost of the same or comparable facilities, by methods of appraisal, or by estimates of current cost reproduction or facility duplication. The nature of the methods adopted depends on the composition of plant assets in the base measure. In the inclusion of nondepreciable plant assets or leased assets, valuation is probably best obtained by use of appraisal techniques; however, in the case of leased assets, the capitalized value of the leasing payments will also suffice if the estimated life of the leased asset corresponds to the length of the leasing committment.

Residual Income Performance Index

In view of the foregoing recommendations, the only remaining deterrent to the use of the residual income measure in evaluating investment center managerial performance is the lack of intersegmental comparability inherent in absolute figures. In order to minimize this tool

weakness, the use of a performance index comparison basis is recommended. The index used should relate actual residual income performance to a predetermined goal range. The minimum and maximum parameters of this range should be based on the segment manager's operating environment expectations; thus, the range established will probably differ for each segment manager. As such, the following 2 versions of a performance index formula can be derived:

$$(1)\quad PI = \frac{RI_a - RI_m}{RI_t - RI_m} \qquad \text{or} \qquad (2)\quad PI = \frac{RI_a - RI_m}{RI_t - RI_a}$$

where: RI_a = Actual residual income
RI_m = Minimum expected residual income
RI_t = Desired residual income target goal

The difference in the above two formulas is one of flexibility. The first formula is applicable regardless of where a segment manager's performance lies with respect to the prescribed parameter range while use of the second formula is limited to those segment managers whose performance falls within this range.

THE NEED FOR ADDITIONAL RESEARCH

The need for further research extends to the following three basic areas:

1. There is a need to establish definite standards for internal measures because measurement rules are subordinate to measurement standards. Until the latter

is established, the validity of the procedures recommended in this study is left in a vacuum and cannot be tested.

2. Some form of correlation study should be undertaken in order to determine the degree of relationship between measurement distortions and motivational response. In otherwords, further analysis on the behavioral implications of performance measures is essential.

3. An analysis of the undergraduate accounting curriculums should be initiated in order to ascertain if they are presently providing the accounting major with a well-rounded exposure to all aspects of industrial accounting practice. In this present study, it is strongly suspected that too much internal accounting exposure is given to product cost determination which results in the student being given a limited exposure to responsibility accounting. More specifically, either there is some deficiency in the accounting education of our corporate controllers or these individuals simply lack the ability to adapt their thought processes from the external to the internal environment. The assumption made here is that corporate controllers influence to some degree the performance measures and procedures used in the evaluation of internal managerial segments. As shown in this study, far too much emphasis is placed on the use of externally-oriented measurement procedures in a situation where they are not applicable.

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APPENDIX A

TRANSMITTAL LETTER
AND
QUESTIONNAIRE

LOUISIANA STATE UNIVERSITY
AND AGRICULTURAL AND MECHANICAL COLLEGE
BATON ROUGE · LOUISIANA · 70803
College of Business Administration

DEPARTMENT OF ACCOUNTING

July 31, 1974

Dear Sir:

As part of my doctoral dissertation research at Louisiana State University, I would like to request your assistance in my study of current industrial practices regarding the classification and performance evaluation of intrafirm segments. The objectives of the enclosed questionnaire in this respect are as follows:

(1) To determine current practice regarding intrafirm classification and performance evaluation techniques,

(2) To analyze the results by comparative measures in an attempt to define and illustrate related problem areas, and

(3) To provide feasible and practical solutions to these problems.

Recognizing the demands upon your time, I have developed a questionnaire which is thorough, yet should take a minimum of your time to complete. Also, your response to this inquiry will be held in strict confidence (the number on the questionnaire is for control purposes only), and no identification of individual firms will be made public from this study. If you should desire a summary of the survey results, simply indicate your request on the last page of the questionnaire.

Your response is vital to the success of this study, and I sincerely hope that you will take the brief time necessary in order to complete this questionnaire.

Upon completion, please return this questionnaire in the enclosed self-addressed, postage-paid envelope as soon as possible. Thank you for your participation and assistance in this research.

Sincerely,

Janice A. Smith

Enclosures

Q U E S T I O N N A I R E

INSTRUCTIONS

Please use the following definitions of the terms "Profit Center" and "Investment Center" in responding to Part II of this questionnaire:

Profit Center: Two or more responsibility segments (divisions, departments, product-lines, decentralized firm activities, etc. within a firm that are each accountable to top management for profitability performance. Each profit center must be able to exercise considerable (though not complete) control over its revenues and expenses.

Investment Center: A profit center becomes an "Investment Center" when, in addition to the above-stated profit responsibility, the segments are also each accountable to top management for investment (asset) utilization in this profit earning process. This implies that each segment must be able to exercise considerable control over the size and composition of its investment base as well as control over its revenues and expenses. Performance measures such as Return on Investment (ROI) and Residual Income (RI) can be applied only in the measurement of an "Investment Center's" performance.

QUESTIONS

I. GENERAL INFORMATION FOR ANALYSIS PURPOSES:

1. Within which industry grouping listed below can your firm BEST be classified? (Circle One)

(1) Appliances, Electronics	(8) Paper, Paper Products
(2) Chemicals, Pharmaceuticals	(9) Petroleum Products, Refining
(3) Communications	(10) Scientific Equipment
(4) Computers, Office Equip.	(11) Textiles, Apparel
(5) Food, Beverages, Tobacco	(12) Vehicles, Vehicle Parts
(6) Industrial Equipment	(13) Wood Products, Furniture
(7) Leisure, Sporting Goods	(14) Other:_____

2. What is the approximate size of your firm in 1973 sales revenue?

	At Least		But Less Than
(1)	$ No Minimum	...	$200 Million
(2)	$200 Million	...	$350 Million
(3)	$350 Million	...	$500 Million
(4)	$500 Million	...	$800 Million
(5)	$800 Million	...	$ 1 Billion
(6)	$ 1 Billion	...	$ 2 Billion
(7)	$ 2 Billion	...	$ No Maximum

II. INFORMATION ON SEGMENTAL CLASSIFICATION FOR PERFORMANCE EVALUATIVE PURPOSES:

3. Does your firm classify its internal segments into "Investment Centers" for purposes of performance evaluation?

(1) NO (2) YES ⟶ (Skip to Question 4 on Next Page)

A. ↓ Does your firm classify its segments instead into "Profit Centers" for performance evaluation purposes?

(a) YES (b) NO

B. Briefly explain why your firm has not adopted the "Investment Center" concept in its classification and evaluation of its segmental organization subunits:

_____

_____

_____

_____

NOTE: PLEASE RETURN THIS QUESTIONNAIRE WITHOUT ANSWERING ANY FURTHER QUESTIONS. THANK YOU FOR YOUR COOPERATION.

III. INFORMATION ON THE NATURE AND COMPOSITION OF "INVESTMENT CENTER" PERFORMANCE EVALUATIVE TOOLS:

4. Does your firm utilize the Return on Investment(ROI) measure in its evaluation of an investment center's performance?

(1) YES (2) NO ⟶ (Skip to Question 6 Below)

A. Which of the following BEST describes your firm's approach in determining an investment center's profit for purposes of the ROI calculation? (Circle One)

(a) Segment Profit = Contribution Margin (i.e., Net Sales less the segment's variable manufacturing, selling, and administrative expenses)
(b) Segment Profit = Performance Margin (i.e., Contribution Margin less fixed expenses that are both directly identifiable with the segment and also controllable by the segment)
(c) Segment Profit = Segment Margin (i.e., Performance Margin less fixed expenses that are directly identifiable with the segment but are not controllable by the segment--depreciation, property taxes on segment equipment, etc.)
(d) Segment Profit = Net Income BEFORE Income Taxes (i.e., Segment Margin less joint or common fixed costs that are not directly identifiable with any specific investment center of the firm and must be allocated to the segments by some means--maintenance expense on a central computer whose services are utilized by a number of segments and/or corporate headquarters)
(e) Segment Profit = Net Income AFTER Income Taxes

5. Does your firm establish ROI Target Rates for its investment centers?

(1) YES (2) NO ⟶ (Skip to Question 6 Below)

A. Which of the following describes the general criteria used by your firm in determining ROI target rates? (Circle all applicable criteria)

(a) Based on corporate cost of capital
(b) Based on corporate rate of return
(c) Based on industry, business, or competitive conditions
(d) Based on future potential or budgeted profit
(e) Based on government regulation
(f) Based on past performance of the investment center
(g) Other Criteria: _____

B. Are the established ROI target rates the same for all investment centers in your firm?

(a) YES (b) NO

6. Does your firm utilize the Residual Income (RI) measure in its evaluation of an investment center's performance?

(1) YES (2) NO ⟶ (Skip to Question 7 on Next Page)

A. In measuring the Residual Income of a segment, which of the following describes the general criteria used by your firm in determining the Capital Charge Rate (or Interest Rate Index)? (Circle all applicable criteria)

(a) Based on segment's overall earnings rate
(b) Based on the firm's overall earnings rate
(c) Based on a target earnings rate
(d) Based on the firm's weighted average cost of capital
(e) Based on the firm's cost of debt
(f) Other Criteria: _____

B. Does your firm apply different capital charge rates (or interest rate indexes)to different classes of assets?

(a) YES (b) NO

C. Does your firm vary the capital charge rate (or interest rate index) from one investment center to another?

(a) YES (b) NO

7. In measuring investment center performance (using Return on Investment, Residual Income, or other methods), does your firm include the following items in the determination of a segment's investment (asset) base? (Indicate by checkoff)

	YES	NO	ITEM NOT APPLICABLE
(1) Current Assets:			
Cash			
Intracompany receivables			
Trade (external) receivables			
Inventories:			
Raw Materials			
Work-in-Process			
Finished Goods (Mdse. Inv.)			
Other Current Assets			
(2) Plant Assets:			
Land and Buildings used solely by one investment center			
Equipment used solely by one investment center			
Land and Buildings used by two or more investment centers			
Equipment used by two or more investment centers			
Land, Buildings, Equipment (ex. computer) that are used by both investment centers and by corporate headquarters			
Land, Buildings, Equipment used solely by corporate headquarters			
Capitalized amount of Property or Equipment that an Investment Center leases from:			
Other Investment Centers within the firm			
Other (Outside) Firms			

8. If your firm carries any of its inventory at L.I.F.O. valuation, are the L.I.F.O. inventories adjusted (before inclusion in the investment base) so that their value approximates current replacement cost valuation (F.I.F.O. would approximate this)?

(1) YES (2) NO (3) NOT APPLICABLE-- L.I.F.O. NOT USED

9. If inventory transfers are made between investment centers within your firm, which of the following BEST describes your firm's internal transfer pricing system? (Circle One)

(1) Transfer pricing not applicable to our firm
(2) Transfer prices are negotiated by the segments involved
(3) Transfer prices are based on marginal cost
(4) Transfer prices are based on standard marginal cost
(5) Transfer prices are based on standard cost + fixed % markup
(6) Transfer prices are based on actual cost + fixed % markup
(7) Transfer price = market selling price on date of transfer
(8) Transfer prices determined by central management only
(9) Other Method(s):_____

10. Which of the following BEST describes your firm's approach to the allocation of common or joint costs to a specific investment center for performance evaluation purposes? (Circle One)

(1) Not applicable--joint costs are not allocated
(2) Allocated according to investment center sales
(3) Allocated according to investment center gross profit
(4) Allocated according to assets employed by the investment center
(5) Allocated according to capital invested during current year
(6) Allocated according to the number of employees in the investment center
(7) Other Method(s):_____

11. Which of the following methods does your firm use in valuing fixed assets (Land, Buildings, Equipment) that are used solely by the investment center being evaluated? (Indicate by checkoff)

	Land	Buildings	Equipment
(1) Gross Book Value (i.e., Cost)..	_____	_____	_____
(2) Net Book Value (i.e., Cost less accumulated depreciation).....	_____	_____	_____
(3) Current Replacement Cost.....	_____	_____	_____
(4) Current Replacement Cost less reasonable depreciation.....	_____	_____	_____
(5) Some measure that departs from Cost (i.e., Market Value, Appraisal Value, Insurance Value, etc.).....	_____	_____	_____

12. If your firm uses "Net Book Value" (as indicated in Question 11) for valuing any of the segment's fixed assets for measurement purposes, does your firm use the same method of depreciation for "investment center" evaluation as it does for external financial reporting?

(1) YES (2) NO (3) NOT APPLICABLE--NET BOOK VALUE NOT USED BY OUR FIRM

13. If your firm includes the capitalized amount of property or equipment that an investment center leases (from either internal or external sources) in the segment's investment base, which of the following BEST describes the way in which your firm arrives at the leased asset's valuation? (Circle One)

(1) Leased property not included in investment center's assets
(2) Leased property included at capitalized value of leasehold
(3) Leased property included at its original cost, or similar measure
(4) Leased property included at its net book value
(5) Other Value:_____

14. Does your firm deduct any of the following in arriving at the investment center's final investment (asset) base for ROI or Residual Income evaluation purposes? (Indicate by checkoff)

	YES	NO	ITEM NOT APPLICABLE
(1) External (trade) current payables	_____	_____	_____
(2) Current payables to other intrafirm segments.....	_____	_____	_____
(3) Other Current Liabilities.....	_____	_____	_____
(4) Non-Current Liabilities.....	_____	_____	_____

IV. INFORMATION ON THE ADEQUACY OF PRESENTLY USED PERFORMANCE EVALUATION TOOLS:

15. Does your firm use any other major method(s)--in addition to ROI and/or Residual Income--in its performance measurement of internal investment center segments?

(1) NO (2) YES (Please Specify):_____

_____

_____

_____

_____

16. Please evaluate the measurement tool(s) your firm uses on the bases of each tool's adequacy in: (1) Effectively evaluating investment center performance, and (2) Positively motivating segment management in accordance with overall firm goals. (Indicate by checkoff)

	Satisfied With Measurement Tool	Measurement Tool Could Be Improved	Measurement Tool Is Inadequate
(1) Measurement Tool as an Effective Evaluator:			
ROI.....	_____	_____	_____
Residual Income...	_____	_____	_____
Other Tool(s).....	_____	_____	_____
(2) Measurement Tool as a Positive Motivator:			
ROI.....	_____	_____	_____
Residual Income...	_____	_____	_____
Other Tool(s).....	_____	_____	_____

Comments:_____

_____

_____

_____

_____

PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED POSTAGE-PAID ENVELOPE. ONCE AGAIN, THANK YOU FOR TAKING THE TIME TO PARTICIPATE IN THIS RESEARCH PROJECT.

APPENDIX B

SENSITIVITY ANALYSIS COMPUTER PROGRAM AND OUTPUT RETURN ON INVESTMENT RESULTS

```
PAGE    1    SMITHJ

// JOB T  2222                                        SMITHJ                  FACULTY

LOG DRIVE    CART SPEC    CART AVAIL  PHY DRIVE
  0000         2222         2222        0001
                            3333        0000

V2 M11   ACTUAL  8K  CONFIG  8K

// COB
*NOXREF

OPTIONS-LIST*STNO*KP26*NOXREF*NODMAP*NOPMAP*NODUMP*NOSUPX*NOSUBR*NOEJCT*1442*1132


STNO - A***B*** C O B O L   S O U R C E   S T A T E M E N T S **********  IDENTFCN  PAGLIN

   1    IDENTIFICATION DIVISION.
   2    PROGRAM-ID.  ROI.
   3    AUTHOR.  JAN SMITH.
   4    REMARKS.  THE PURPOSE OF THIS PROGRAM IS TO ILLUSTRATE ROI RATE
            SENSITIVITY RELATIVE TO INPUT COMPOSITION.  ACCORDINGLY,
            BASED ON REAL INTERNAL DATA COMPILED FROM A SELECTED
            CORPORATION, SEVERAL SERIES OF CORPORATE AND SEGMENTAL ROI
            SENSITIVITY OR ELASTICITY RANGES ARE HEREIN DEVELOPED.
            PHASE-1 OF THIS PROGRAM ESTABLISHES THE INITIAL R.O.I.
            SENSITIVITY PARAMETER RANGE FOR THE CORPORATION AS A
            WHOLE AS WELL AS FOR EACH SEGMENT, UTILIZING THE EXISTING
            CORPORATE DATA SITUATION (1974 FIGURES).  THE REMAINING
            PHASES EMPHASIZE ACTIVITY WITHIN THE INDUSTRIAL PRODUCT
            SECTOR ONLY.  IN THIS RESPECT, PHASE-2 ANALYZES R.O.I.
            ASSUMING THAT DURING 1974 A CONVERSION FROM F.I.F.O.
            TO L.I.F.O. INVENTORY VALUATION OCCURRED (THIS MOVE IS
            PRESENTLY BEING SERIOUSLY CONTEMPLATED BY THIS
            CORPORATION).  PHASE-3 AND PHASE-4 BOTH DEAL WITH PLANT
            ASSET REPLACEMENT DECISIONS (UNIFORM DOLLAR VERSUS
            UNIFORM PERCENTAGE IN EACH SEGMENT).  PHASE-5
            COMPLETES THE SENSITIVITY ANALYSIS BY A HYPOTHETICAL
            SITUATION IN WHICH IT IS ASSUMED THAT 50 PERCENT OF THE PLANT
            ASSETS CONTROLLED BY THE INDUSTRIAL CHEMICALS SEGMENT
            WERE INITIALLY LEASED INSTEAD OF PURCHASED AND LEASING
            COSTS WERE NOT CAPITALIZED (IN REALITY, THIS CORPORATION
            DOES NOT UTILIZE THE FINANCIAL OPTION OF LEASING).
   5    ENVIRONMENT DIVISION.
   6    CONFIGURATION SECTION.
   7    SOURCE-COMPUTER.  IBM-1130.
   8    OBJECT-COMPUTER.  IBM-1130.
   9    SPECIAL-NAMES.
            C01 IS PAGE-TOP.
  10    INPUT-OUTPUT SECTION.
  11    FILE-CONTROL.
  12        SELECT RESEARCH-FILE ASSIGN TO RD-1442.
  13        SELECT RESULTS-FILE ASSIGN TO PR-1132-C.
  14    DATA DIVISION.
  15    FILE SECTION.
  16    FD  RESEARCH-FILE
            LABEL RECORDS ARE OMITTED
            DATA RECORD IS FIGURES-IN.
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STMD - A...B... C O B O L   S O U R C E   S T A T E M E N T S .......... IDENTFCN  PAGLIN
  17   01  FIGURES-IN.
  18       02  CODE-A              PIC X.
  19       02  CODE-B              PIC X.
  20       02  ASSET-BASE          PIC 9(5).
  21       02  PROFIT-1            PIC 9(4).
  22       02  PROFIT-2            PIC 9(4).
  23       02  PROFIT-3            PIC 9(4).
  24       02  PROFIT-4            PIC 9(4).
  25       02  PROFIT-5            PIC 9(4).
  26   FD  RESULTS-FILE
           LABEL RECORDS ARE OMITTED
           DATA RECORD IS ANS-OUT.
  27   01  ANS-OUT                 PIC X(121).
  28   WORKING-STORAGE SECTION.
  29   77  ITEM-1                  PIC 99      VALUE IS 16.
  30   77  ITEM-2                  PIC 9       VALUE IS 5.
  31   77  ITEM-3                  PIC 99      VALUE IS 14.
  32   77  S                       PIC 9       VALUE IS 7.
  33   77  M                       PIC 99      VALUE IS 11.
  34   77  I                       PIC 99      VALUE IS 15.
  35   77  T                       PIC 99      VALUE IS 19.
  36   77  H                       PIC 99      VALUE IS 21.
  37   77  ROW                     PIC 9       VALUE IS 1.
  38   77  COL                     PIC 9       VALUE IS 1.
  39   77  MATRIX-CTR              PIC 99      VALUE IS 1.
  40   01  CODES-B.
  41       02  CODE-CTR OCCURS 6 TIMES PIC X.
  42   01  ASSET-DATA.
  43       02  ASSETS OCCURS 6 TIMES PIC 9(5).
  44   01  INCOME-DATA.
  45       02  DATA-ITEMS OCCURS 6 TIMES.
  46           03  INCOME OCCURS 5 TIMES PIC 9(4).
  47   01  ROI-TABLE.
  48       02  ANS-ITEMS OCCURS 6 TIMES.
  49           03  ROI-RATE OCCURS 5 TIMES PIC 999V99.
  50   01  ROI-ANS.
  51       02  FILLER              PIC X(57)   VALUE SPACES.
  52       02  ANS-1               PIC ZZ9.99.
  53       02  FILLER              PIC X(7)    VALUE SPACES.
  54       02  ANS-2               PIC ZZ9.99.
  55       02  FILLER              PIC X(5)    VALUE SPACES.
  56       02  ANS-3               PIC ZZ9.99.
  57       02  FILLER              PIC X(6)    VALUE SPACES.
  58       02  ANS-4               PIC ZZ9.99.
  59       02  FILLER              PIC X(8)    VALUE SPACES.
  60       02  ANS-5               PIC ZZ9.99.
  61       02  FILLER              PIC X(8)    VALUE SPACES.
  62   01  TEST-HEAD.
  63       02  FILLER              PIC X(29)   VALUE SPACES.
  64       02  FILLER              PIC X(63)   VALUE 'I N D U S T R I A L
     -         'P R O D U C T - L I N E   S E G M E N T S'.
  65       02  FILLER              PIC X(29)   VALUE SPACES.
  66   01  LIFO.
  67       02  FILLER              PIC X(34)   VALUE SPACES.
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STNO - A...B... C O B O L   S O U R C E   S T A T E M E N T S .......... IDENTFCN  PAGLIN
  68         02  FILLER          PIC X(53)   VALUE '(EFFECT ON R.O.I. OF I
     -           'NVENTORY VALUATION AT L.I.F.O.)'.
  69         02  FILLER          PIC X(24)   VALUE SPACES.
  70     01  DEPR-1.
  71         02  FILLER          PIC X(30)   VALUE SPACES.
  72         02  FILLER          PIC X(61)   VALUE '(EFFECT ON R.O.I. OF U
     -           'NIFORM DOLLAR PLANT ASSET REPLACEMENTS)'.
  73         02  FILLER          PIC X(30)   VALUE SPACES.
  74     01  DEPR-2.
  75         02  FILLER          PIC X(28)   VALUE SPACES.
  76         02  FILLER          PIC X(65)   VALUE '(EFFECT ON R.O.I. OF U
     -           'NIFORM PERCENTAGE PLANT ASSET REPLACEMENTS)'.
  77         02  FILLER          PIC X(28)   VALUE SPACES.
  78     01  LEASE.
  79         02  FILLER          PIC X(24)   VALUE SPACES.
  80         02  FILLER          PIC X(74)   VALUE '(EFFECT ON R.O.I. OF I
     -           'NITIALLY LEASING INSTEAD OF PURCHASING PLANT ASSETS)'.
  81         02  FILLER          PIC X(23)   VALUE SPACES.
  82     01  HEAD-0.
  83         02  FILLER          PIC X(37)   VALUE SPACES.
  84         02  FILLER          PIC X(47)   VALUE
             'A N   A N O N Y M O U S   C O R P O R A T I O N'.
  85         02  FILLER          PIC X(37)   VALUE SPACES.
  86     01  HEAD-1.
  87         02  FILLER          PIC X(41)   VALUE SPACES.
  88         02  FILLER          PIC X(39)   VALUE
             'R E T U R N   O N   I N V E S T M E N T'.
  89         02  FILLER          PIC X(41)   VALUE SPACES.
  90     01  HEAD-2.
  91         02  FILLER          PIC X(32)   VALUE SPACES.
  92         02  FILLER          PIC X(57)   VALUE 'S E N S I T I V I T Y
     -           ' P E R C E N T A G E   R A N G E S'.
  93         02  FILLER          PIC X(32)   VALUE SPACES.
  94     01  CORP.
  95         02  FILLER          PIC X(40)   VALUE SPACES.
  96         02  FILLER          PIC X(40)   VALUE
             'CONSOLIDATED CORPORATE SENSITIVITY RANGE'.
  97         02  FILLER          PIC X(41)   VALUE SPACES.
  98     01  CONSUMER.
  99         02  FILLER          PIC X(40)   VALUE SPACES.
 100         02  FILLER          PIC X(40)   VALUE
             'CONSUMER PRODUCT-GROUP SENSITIVITY RANGE'.
 101         02  FILLER          PIC X(41)   VALUE SPACES.
 102     01  INDUSTRIAL.
 103         02  FILLER          PIC X(39)   VALUE SPACES.
 104         02  FILLER          PIC X(42)   VALUE
             'INDUSTRIAL PRODUCT-GROUP SENSITIVITY RANGE'.
 105         02  FILLER          PIC X(40)   VALUE SPACES.
 106     01  I-PLASTICS.
 107         02  FILLER          PIC X(31)   VALUE SPACES.
 108         02  FILLER          PIC X(58)   VALUE 'INDUSTRIAL PLASTICS PR
     -           'ODUCT-LINE SEGMENT SENSITIVITY RANGE'.
 109         02  FILLER          PIC X(32)   VALUE SPACES.
 110     01  I-CHEMICALS.
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STNO - A...B... C O B O L   S O U R C E   S T A T E M E N T S .......... IDENTFCN  PAGLIN
 111         02  FILLER          PIC X(31)   VALUE SPACES.
 112         02  FILLER          PIC X(58)   VALUE 'INDUSTRIAL CHEMICAL PR
     -           'ODUCT-LINE SEGMENT SENSITIVITY RANGE'.
 113         02  FILLER          PIC X(32)   VALUE SPACES.
 114     01  I-SYNTHETICS.
 115         02  FILLER          PIC X(30)   VALUE SPACES.
 116         02  FILLER          PIC X(60)   VALUE 'INDUSTRIAL SYNTHETICS
     -           'PRODUCT-LINE SEGMENT SENSITIVITY RANGE'.
 117         02  FILLER          PIC X(31)   VALUE SPACES.
 118     01  DASHES-1.
 119         02  FILLER          PIC X(5)    VALUE SPACES.
 120         02  FILLER          PIC X(111)  VALUE IS ALL '='.
 121         02  FILLER          PIC X(5)    VALUE SPACES.
 122     01  DASHES-2.
 123         02  FILLER          PIC X(54)   VALUE SPACES.
 124         02  FILLER          PIC X(62)   VALUE IS ALL '='.
 125         02  FILLER          PIC X(5)    VALUE SPACES.
 126     01  HEAD-3.
 127         02  FILLER          PIC X(54)   VALUE SPACES.
 128         02  FILLER          PIC X(62)   VALUE '                    P
     -           'R O F I T   B A S E                 '.
 129         02  FILLER          PIC X(5)    VALUE SPACES.
 130     01  HEAD-4.
 131         02  FILLER          PIC X(5)    VALUE SPACES.
 132         02  FILLER          PIC X(49)   VALUE
                 '          I N V E S T M E N T   B A S E          '.
 133         02  FILLER          PIC X(14)   VALUE 'CONTRIBUTION  '.
 134         02  FILLER          PIC X(13)   VALUE 'PERFORMANCE  '.
 135         02  FILLER          PIC X(10)   VALUE 'SEGMENT   '.
 136         02  FILLER          PIC X(14)   VALUE 'NET INCOME    '.
 137         02  FILLER          PIC X(11)   VALUE 'NET INCOME '.
 138         02  FILLER          PIC X(5)    VALUE SPACES.
 139     01  HEAD-5.
 140         02  FILLER          PIC X(57)   VALUE SPACES.
 141         02  FILLER          PIC X(13)   VALUE 'MARGIN       '.
 142         02  FILLER          PIC X(11)   VALUE 'MARGIN     '.
 143         02  FILLER          PIC X(9)    VALUE 'MARGIN   '.
 144         02  FILLER          PIC X(14)   VALUE 'BEFORE TAXES  '.
 145         02  FILLER          PIC X(12)   VALUE 'AFTER  TAXES'.
 146         02  FILLER          PIC X(5)    VALUE SPACES.
 147     01  RESULTS-1.
 148         02  FILLER          PIC X(5)    VALUE SPACES.
 149         02  FILLER          PIC X(52)   VALUE
                 'PLANT ASSETS AT BOOK VALUE----------------------   '.
 150         02  FILLER          PIC X(64)   VALUE SPACES.
 151     01  RESULTS-2.
 152         02  FILLER          PIC X(5)    VALUE SPACES.
 153         02  FILLER          PIC X(52)   VALUE
                 'PLANT ASSETS AT COST----------------------------   '.
 154         02  FILLER          PIC X(64)   VALUE SPACES.
 155     01  RESULTS-3.
 156         02  FILLER          PIC X(5)    VALUE SPACES.
 157         02  FILLER          PIC X(52)   VALUE
                 'PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL--   '.
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STNO - A...B... C O B O L   S O U R C E   S T A T E M E N T S .........  IDENTFCN  PAGLIN
  158        02  FILLER              PIC X(64)   VALUE SPACES.
  159    01  RESULTS-4.
  160        02  FILLER              PIC X(5)    VALUE SPACES.
  161        02  FILLER              PIC X(52)   VALUE
                 'PLANT ASSETS AT COST PLUS WORKING CAPITAL--------   '.
  162        02  FILLER              PIC X(64)   VALUE SPACES.
  163    01  RESULTS-5.
  164        02  FILLER              PIC X(5)    VALUE SPACES.
  165        02  FILLER              PIC X(52)   VALUE
                 'TOTAL ASSETS AT BOOK VALUE----------------------   '.
  166        02  FILLER              PIC X(64)   VALUE SPACES.
  167    01  RESULTS-6.
  168        02  FILLER              PIC X(5)    VALUE SPACES.
  169        02  FILLER              PIC X(52)   VALUE
                 'TOTAL ASSETS AT COST----------------------------   '.
  170        02  FILLER              PIC X(64)   VALUE SPACES.
  171    PROCEDURE DIVISION.
  172    PRELIMINARY.
  173        OPEN INPUT RESEARCH-FILE, OUTPUT RESULTS-FILE.
  174        WRITE ANS-OUT FROM SPACES AFTER ADVANCING PAGE-TOP.
  175        WRITE ANS-OUT FROM HEAD-0 AFTER ADVANCING ITEM-1.
  176        WRITE ANS-OUT FROM HEAD-1 AFTER ADVANCING 2.
  177        WRITE ANS-OUT FROM HEAD-2 AFTER ADVANCING 2.
  178        MOVE 1 TO ROW.
  179        MOVE 1 TO COL.
  180    PHASE-1.
  181        PERFORM DATA-IN VARYING ROW FROM 1 BY 1
                 UNTIL ROW IS GREATER THAN 6.
  182        MOVE 1 TO ROW.
  183        PERFORM CALCULATIONS VARYING ROW FROM 1 BY 1
                 UNTIL ROW IS GREATER THAN 6.
  184        MOVE 1 TO ROW.
  185        GO TO ROI-OUT.
  186    DATA-IN.
  187        READ RESEARCH-FILE AT END GO TO WRAPUP.
  189        MOVE CODE-B TO CODE-CTR (ROW).
  190        MOVE ASSET-BASE TO ASSETS (ROW).
  191        MOVE PROFIT-1 TO INCOME (ROW, COL).
  192        ADD 1 TO COL.
  193        MOVE PROFIT-2 TO INCOME (ROW, COL).
  194        ADD 1 TO COL.
  195        MOVE PROFIT-3 TO INCOME (ROW, COL).
  196        ADD 1 TO COL.
  197        MOVE PROFIT-4 TO INCOME (ROW, COL).
  198        ADD 1 TO COL.
  199        MOVE PROFIT-5 TO INCOME (ROW, COL).
  200        MOVE 1 TO COL.
  201        IF CODE-A = '1' WRITE ANS-OUT FROM CORP AFTER
                 ADVANCING 3.
  203        IF CODE-A = '2' WRITE ANS-OUT FROM SPACES AFTER
  205            ADVANCING PAGE-TOP WRITE ANS-OUT FROM SPACES AFTER
  206            ADVANCING ITEM-2 WRITE ANS-OUT FROM CONSUMER AFTER
                 ADVANCING 3.
  207        IF CODE-A = '3' WRITE ANS-OUT FROM INDUSTRIAL AFTER
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STNO - A...B... C O B O L   S O U R C E   S T A T E M E N T S .........  IDENTFCN  PAGLIN
                    ADVANCING 3.
209                 IF CODE-A = '4' WRITE ANS-OUT FROM SPACES AFTER
211                     ADVANCING PAGE-TOP WRITE ANS-OUT FROM SPACES AFTER
212                     ADVANCING ITEM-2 WRITE ANS-OUT FROM I-PLASTICS AFTER
                        ADVANCING 3.
213                 IF CODE-A = '5' WRITE ANS-OUT FROM I-CHEMICALS AFTER
                        ADVANCING 3.
215                 IF CODE-A = '6' WRITE ANS-OUT FROM SPACES AFTER
217                     ADVANCING PAGE-TOP WRITE ANS-OUT FROM SPACES AFTER
218                     ADVANCING ITEM-1 WRITE ANS-OUT FROM I-SYNTHETICS AFTER
                        ADVANCING 3.
219                 IF CODE-A = '7' WRITE ANS-OUT FROM SPACES AFTER
221                     ADVANCING PAGE-TOP WRITE ANS-OUT FROM SPACES AFTER
222                     ADVANCING ITEM-1 WRITE ANS-OUT FROM I-CHEMICALS AFTER
                        ADVANCING 3.
223                 IF CODE-A NOT = '0' WRITE ANS-OUT FROM DASHES-1 AFTER
225                     ADVANCING 2 WRITE ANS-OUT FROM HEAD-3 AFTER
226                     ADVANCING 1 WRITE ANS-OUT FROM DASHES-2 AFTER
227                     ADVANCING 1 WRITE ANS-OUT FROM HEAD-4 AFTER
228                     ADVANCING 1 WRITE ANS-OUT FROM HEAD-5 AFTER
229                     ADVANCING 1 WRITE ANS-OUT FROM DASHES-1 AFTER
                        ADVANCING 1.
230             TEST-HEADINGS.
231                 WRITE ANS-OUT FROM SPACES AFTER ADVANCING PAGE-TOP.
232                 WRITE ANS-OUT FROM TEST-HEAD AFTER ADVANCING ITEM-3.
233                 WRITE ANS-OUT FROM HEAD-1 AFTER ADVANCING 2.
234                 WRITE ANS-OUT FROM HEAD-2 AFTER ADVANCING 2.
235             ROI-TRANSFER.
236                 MOVE ROI-RATE (ROW, COL) TO ANS-1.
237                 ADD 1 TO COL.
238                 MOVE ROI-RATE (ROW, COL) TO ANS-2.
239                 ADD 1 TO COL.
240                 MOVE ROI-RATE (ROW, COL) TO ANS-3.
241                 ADD 1 TO COL.
242                 MOVE ROI-RATE (ROW, COL) TO ANS-4.
243                 ADD 1 TO COL.
244                 MOVE ROI-RATE (ROW, COL) TO ANS-5.
245                 MOVE 1 TO COL.
246                 IF CODE-CTR (ROW) = '1' WRITE ANS-OUT FROM SPACES AFTER
248                     ADVANCING 1 WRITE ANS-OUT FROM RESULTS-1 AFTER
                        ADVANCING 1.
249                 IF CODE-CTR (ROW) = '2' WRITE ANS-OUT FROM RESULTS-2 AFTER
                        ADVANCING 1.
251                 IF CODE-CTR (ROW) = '3' WRITE ANS-OUT FROM RESULTS-3 AFTER
                        ADVANCING 1.
253                 IF CODE-CTR (ROW) = '4' WRITE ANS-OUT FROM RESULTS-4 AFTER
                        ADVANCING 1.
255                 IF CODE-CTR (ROW) = '5' WRITE ANS-OUT FROM RESULTS-5 AFTER
                        ADVANCING 1.
257                 IF CODE-CTR (ROW) = '6' WRITE ANS-OUT FROM RESULTS-6 AFTER
                        ADVANCING 1.
259                 WRITE ANS-OUT FROM ROI-ANS BEFORE ADVANCING 1.
260                 IF ROW = 6 WRITE ANS-OUT FROM DASHES-1 AFTER ADVANCING 1.
262             CALCULATIONS.
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STNO - A...B... C O B O L   S O U R C E   S T A T E M E N T S .........  IDENTFCN  PAGLIN
 263         COMPUTE ROI-RATE (ROW, COL) ROUNDED =
                 (INCOME (ROW, COL) / ASSETS (ROW)) * 100.
 264         ADD 1 TO COL.
 265         COMPUTE ROI-RATE (ROW, COL) ROUNDED =
                 (INCOME (ROW, COL) / ASSETS (ROW)) * 100.
 266         ADD 1 TO COL.
 267         COMPUTE ROI-RATE (ROW, COL) ROUNDED =
                 (INCOME (ROW, COL) / ASSETS (ROW)) * 100.
 268         ADD 1 TO COL.
 269         COMPUTE ROI-RATE (ROW, COL) ROUNDED =
                 (INCOME (ROW, COL) / ASSETS (ROW)) * 100.
 270         ADD 1 TO COL.
 271         COMPUTE ROI-RATE (ROW, COL) ROUNDED =
                 (INCOME (ROW, COL) / ASSETS (ROW)) * 100.
 272         MOVE 1 TO COL.
 273     ROI-OUT.
 274         PERFORM ROI-TRANSFER VARYING ROW FROM 1 BY 1
                 UNTIL ROW IS GREATER THAN 6.
 275         MOVE 1 TO ROW.
 276         ADD 1 TO MATRIX-CTR.
 277         IF MATRIX-CTR = 5 GO TO PHASE-2 ELSE NEXT SENTENCE.
 279         IF MATRIX-CTR = 4 GO TO PHASE-3 ELSE NEXT SENTENCE.
 281         IF MATRIX-CTR = 3 GO TO PHASE-4 ELSE NEXT SENTENCE.
 283         IF MATRIX-CTR = 2 GO TO PHASE-5 ELSE NEXT SENTENCE.
 285         IF MATRIX-CTR = 6 GO TO WRAPUP ELSE NEXT SENTENCE.
 287         GO TO PHASE-1.
 288     PHASE-2.
 289         PERFORM TEST-HEADINGS.
 290         WRITE ANS-OUT FROM LIFO AFTER ADVANCING 2.
 291         GO TO PHASE-1.
 292     PHASE-3.
 293         PERFORM TEST-HEADINGS.
 294         WRITE ANS-OUT FROM DEPR-1 AFTER ADVANCING 2.
 295         GO TO PHASE-1.
 296     PHASE-4.
 297         PERFORM TEST-HEADINGS.
 298         WRITE ANS-OUT FROM DEPR-2 AFTER ADVANCING 2.
 299         GO TO PHASE-1.
 300     PHASE-5.
 301         PERFORM TEST-HEADINGS.
 302         WRITE ANS-OUT FROM LEASE AFTER ADVANCING 2.
 303         GO TO PHASE-1.
 304     WRAPUP.
 305         CLOSE RESEARCH-FILE, RESULTS-FILE.
 306         STOP RUN.
/*

NO ERRORS DETECTED IN THIS COMPILATION

PROGRAM-SIZE = TALLY + FILE SECTION + W-S SECTION + CONSTANTS + TEMP-LOCNS + PROCEDURES + ARITH-STACK
    5526         2         157          3496          19          18          1810          24
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AN ANONYMOUS CORPORATION

RETURN ON INVESTMENT

SENSITIVITY PERCENTAGE RANGES

CONSOLIDATED CORPORATE SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	106.77	53.02	48.61	37.08	16.92
PLANT ASSETS AT COST	61.89	30.73	28.18	21.49	9.81
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	61.81	30.69	28.14	21.47	9.80
PLANT ASSETS AT COST PLUS WORKING CAPITAL	43.54	21.62	19.82	15.12	6.90
TOTAL ASSETS AT BOOK VALUE	41.16	20.44	18.74	14.30	6.52
TOTAL ASSETS AT COST	32.17	15.97	14.65	11.17	5.10

CONSUMER PRODUCT-GROUP SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	191.37	87.54	85.14	56.47	38.74
PLANT ASSETS AT COST	73.00	33.39	32.48	21.54	14.78
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	92.37	42.25	41.09	27.26	18.70
PLANT ASSETS AT COST PLUS WORKING CAPITAL	51.82	23.70	23.05	15.29	10.49
TOTAL ASSETS AT BOOK VALUE	44.65	20.42	19.87	13.18	9.04
TOTAL ASSETS AT COST	32.40	14.82	14.41	9.56	6.56

INDUSTRIAL PRODUCT-GROUP SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	104.97	58.53	53.06	47.50	24.33
PLANT ASSETS AT COST	68.92	38.43	34.84	31.19	15.97
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	60.07	33.49	30.37	27.19	13.92
PLANT ASSETS AT COST PLUS WORKING CAPITAL	46.23	25.78	23.37	20.92	10.71
TOTAL ASSETS AT BOOK VALUE	44.76	24.96	22.62	20.26	10.37
TOTAL ASSETS AT COST	36.60	20.41	18.50	16.56	8.48

INDUSTRIAL PLASTICS PRODUCT-LINE SEGMENT SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	105.97	38.19	36.71	33.09	18.46
PLANT ASSETS AT COST	83.11	29.95	28.79	25.95	14.47
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	92.88	33.47	32.18	29.00	16.18
PLANT ASSETS AT COST PLUS WORKING CAPITAL	74.83	26.97	25.92	23.36	13.03
TOTAL ASSETS AT BOOK VALUE	59.45	21.42	20.59	18.56	10.35
TOTAL ASSETS AT COST	51.50	18.56	17.84	16.08	8.97

INDUSTRIAL CHEMICAL PRODUCT-LINE SEGMENT SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	87.23	64.15	57.49	52.21	24.97
PLANT ASSETS AT COST	43.62	32.08	28.74	26.10	12.49
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	48.66	35.78	32.07	29.12	13.93
PLANT ASSETS AT COST PLUS WORKING CAPITAL	31.23	22.97	20.58	18.69	8.94
TOTAL ASSETS AT BOOK VALUE	36.74	27.02	24.21	21.99	10.52
TOTAL ASSETS AT COST	25.85	19.01	17.04	15.47	7.40

INDUSTRIAL SYNTHETICS PRODUCT-LINE SEGMENT SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	160.74	89.16	78.63	69.26	35.68
PLANT ASSETS AT COST	152.70	84.70	74.70	65.80	33.90
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	57.88	32.11	28.32	24.94	12.85
PLANT ASSETS AT COST PLUS WORKING CAPITAL	56.81	31.51	27.79	24.48	12.61
TOTAL ASSETS AT BOOK VALUE	46.23	25.64	22.62	19.92	10.26
TOTAL ASSETS AT COST	45.54	25.26	22.28	19.62	10.11

INDUSTRIAL PRODUCT-LINE SEGMENTS

RETURN ON INVESTMENT

SENSITIVITY PERCENTAGE RANGES

(EFFECT ON R.O.I. OF INVENTORY VALUATION AT L.I.F.O.)

INDUSTRIAL PRODUCT-GROUP SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	82.66	36.22	30.75	25.20	14.11
PLANT ASSETS AT COST	54.27	23.78	20.19	16.54	9.26
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	54.23	23.76	20.17	16.53	9.25
PLANT ASSETS AT COST PLUS WORKING CAPITAL	40.38	17.69	15.02	12.31	6.89
TOTAL ASSETS AT BOOK VALUE	38.95	17.07	14.49	11.87	6.65
TOTAL ASSETS AT COST	31.25	13.69	11.63	9.52	5.33

INDUSTRIAL PLASTICS PRODUCT-LINE SEGMENT SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	99.26	31.48	30.00	26.38	14.77
PLANT ASSETS AT COST	77.84	24.68	23.53	20.68	11.58
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	92.44	29.31	27.94	24.56	13.75
PLANT ASSETS AT COST PLUS WORKING CAPITAL	73.58	23.33	22.24	19.55	10.95
TOTAL ASSETS AT BOOK VALUE	57.86	18.35	17.49	15.38	8.61
TOTAL ASSETS AT COST	49.87	15.81	15.07	13.25	7.42

INDUSTRIAL CHEMICAL PRODUCT-LINE SEGMENT SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	44.77	21.69	15.03	9.74	5.49
PLANT ASSETS AT COST	22.38	10.85	7.51	4.87	2.74
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	32.72	15.85	10.98	7.12	4.01
PLANT ASSETS AT COST PLUS WORKING CAPITAL	18.90	9.16	6.34	4.11	2.32
TOTAL ASSETS AT BOOK VALUE	22.96	11.13	7.71	5.00	2.81
TOTAL ASSETS AT COST	15.18	7.35	5.09	3.30	1.86

INDUSTRIAL SYNTHETICS PRODUCT-LINE SEGMENT SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	150.21	78.63	68.11	58.74	34.00
PLANT ASSETS AT COST	142.70	74.70	64.70	55.80	32.30
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	56.23	29.43	25.49	21.99	12.73
PLANT ASSETS AT COST PLUS WORKING CAPITAL	55.14	28.86	25.00	21.56	12.48
TOTAL ASSETS AT BOOK VALUE	44.55	23.32	20.20	17.42	10.08
TOTAL ASSETS AT COST	43.87	22.96	19.89	17.15	9.93

INDUSTRIAL PRODUCT-LINE SEGMENTS

RETURN ON INVESTMENT

SENSITIVITY PERCENTAGE RANGES

(EFFECT ON R.O.I. OF UNIFORM DOLLAR PLANT ASSET REPLACEMENTS)

INDUSTRIAL PRODUCT-GROUP SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	81.82	45.62	41.36	37.03	18.96
PLANT ASSETS AT COST	63.75	35.54	32.22	28.85	14.77
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	51.70	28.83	26.13	23.40	11.98
PLANT ASSETS AT COST PLUS WORKING CAPITAL	43.85	24.45	22.16	19.84	10.16
TOTAL ASSETS AT BOOK VALUE	39.94	22.27	20.19	18.07	9.26
TOTAL ASSETS AT COST	35.08	19.56	17.73	15.88	8.13

INDUSTRIAL PLASTICS PRODUCT-LINE SEGMENT SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	83.54	30.11	28.94	26.08	14.55
PLANT ASSETS AT COST	75.55	27.22	26.17	23.59	13.16
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	75.19	27.10	26.05	23.48	13.10
PLANT ASSETS AT COST PLUS WORKING CAPITAL	68.65	24.74	23.78	21.43	11.96
TOTAL ASSETS AT BOOK VALUE	51.67	18.62	17.90	16.13	9.00
TOTAL ASSETS AT COST	48.50	17.48	16.80	15.14	8.45

INDUSTRIAL CHEMICAL PRODUCT-LINE SEGMENT SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	65.02	47.82	42.85	38.91	18.62
PLANT ASSETS AT COST	41.59	30.59	27.41	24.89	11.91
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	40.87	30.06	26.93	24.46	11.70
PLANT ASSETS AT COST PLUS WORKING CAPITAL	30.18	22.20	19.89	18.06	8.64
TOTAL ASSETS AT BOOK VALUE	32.12	23.62	21.17	19.22	9.20
TOTAL ASSETS AT COST	25.13	18.48	16.56	15.04	7.19

INDUSTRIAL SYNTHETICS PRODUCT-LINE SEGMENT SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	128.54	71.30	62.88	55.39	28.54
PLANT ASSETS AT COST	128.32	71.18	62.77	55.29	28.49
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	53.09	29.45	25.97	22.88	11.79
PLANT ASSETS AT COST PLUS WORKING CAPITAL	53.06	29.43	25.96	22.86	11.78
TOTAL ASSETS AT BOOK VALUE	43.12	23.92	21.10	18.58	9.57
TOTAL ASSETS AT COST	43.10	23.91	21.08	18.57	9.57

INDUSTRIAL PRODUCT-LINE SEGMENTS

RETURN ON INVESTMENT

SENSITIVITY PERCENTAGE RANGES

(EFFECT ON R.O.I. OF UNIFORM PERCENTAGE PLANT ASSET REPLACEMENTS)

INDUSTRIAL PRODUCT-GROUP SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	78.09	43.54	39.47	35.34	18.10
PLANT ASSETS AT COST	63.75	35.54	32.22	28.85	14.77
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	50.19	27.98	25.37	22.71	11.63
PLANT ASSETS AT COST PLUS WORKING CAPITAL	43.85	24.45	22.16	19.84	10.16
TOTAL ASSETS AT BOOK VALUE	39.03	21.76	19.73	17.66	9.05
TOTAL ASSETS AT COST	35.08	19.56	17.73	15.88	8.13

INDUSTRIAL PLASTICS PRODUCT-LINE SEGMENT SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	86.47	31.16	29.96	27.00	15.06
PLANT ASSETS AT COST	76.65	27.62	26.55	23.93	13.35
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	77.55	27.95	26.87	24.21	13.51
PLANT ASSETS AT COST PLUS WORKING CAPITAL	69.56	25.07	24.10	21.72	12.11
TOTAL ASSETS AT BOOK VALUE	52.77	19.02	18.28	16.48	9.19
TOTAL ASSETS AT COST	48.95	17.64	16.96	15.28	8.52

INDUSTRIAL CHEMICAL PRODUCT-LINE SEGMENT SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	54.92	40.39	36.20	32.87	15.72
PLANT ASSETS AT COST	40.23	29.59	26.51	24.08	11.52
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	36.64	26.94	24.14	21.93	10.49
PLANT ASSETS AT COST PLUS WORKING CAPITAL	29.46	21.67	19.41	17.63	8.43
TOTAL ASSETS AT BOOK VALUE	29.44	21.65	19.40	17.62	8.43
TOTAL ASSETS AT COST	24.62	18.11	16.23	14.74	7.05

INDUSTRIAL SYNTHETICS PRODUCT-LINE SEGMENT SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	145.01	80.44	70.94	62.49	32.19
PLANT ASSETS AT COST	141.13	78.28	69.04	60.81	31.33
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	55.71	30.90	27.25	24.01	12.37
PLANT ASSETS AT COST PLUS WORKING CAPITAL	55.13	30.58	26.97	23.75	12.24
TOTAL ASSETS AT BOOK VALUE	44.83	24.87	21.93	19.32	9.95
TOTAL ASSETS AT COST	44.45	24.66	21.75	19.16	9.87

INDUSTRIAL PRODUCT-LINE SEGMENTS

RETURN ON INVESTMENT

SENSITIVITY PERCENTAGE RANGES

(EFFECT ON R.O.I. OF INITIALLY LEASING INSTEAD OF PURCHASING PLANT ASSETS)

INDUSTRIAL PRODUCT-GROUP SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	133.14	70.93	64.00	56.95	29.04
PLANT ASSETS AT COST	95.44	50.85	45.88	40.82	20.82
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	68.35	36.41	32.85	29.24	14.91
PLANT ASSETS AT COST PLUS WORKING CAPITAL	56.83	30.27	27.31	24.31	12.39
TOTAL ASSETS AT BOOK VALUE	49.20	26.21	23.65	21.04	10.73
TOTAL ASSETS AT COST	42.93	22.87	20.64	18.36	9.36

INDUSTRIAL CHEMICAL PRODUCT-LINE SEGMENT SENSITIVITY RANGE

INVESTMENT BASE	PROFIT BASE				
	CONTRIBUTION MARGIN	PERFORMANCE MARGIN	SEGMENT MARGIN	NET INCOME BEFORE TAXES	NET INCOME AFTER TAXES
PLANT ASSETS AT BOOK VALUE	174.46	116.00	102.67	92.10	43.18
PLANT ASSETS AT COST	87.23	58.00	51.33	46.05	21.59
PLANT ASSETS AT BOOK VALUE PLUS WORKING CAPITAL	67.47	44.86	39.71	35.62	16.70
PLANT ASSETS AT COST PLUS WORKING CAPITAL	48.66	32.35	28.63	25.69	12.04
TOTAL ASSETS AT BOOK VALUE	46.54	30.94	27.39	24.57	11.52
TOTAL ASSETS AT COST	36.74	24.43	21.62	19.40	9.09

VITA

Janice A. Smith, daughter of Dexter A. and Amelia (Guertin) Smith, was born in Cranston, Rhode Island on February 16, 1945. In the Fall of 1964, she entered Bryant College in Smithfield, Rhode Island where in June, 1968 she received the degree of Bachelor of Science in Business Education (summa cum laude). In the Fall of 1968, she entered the Graduate School at Ohio University in Athens, Ohio where she held both a graduate fellowship in Business Administration and a teaching grant in Accounting. In December, 1969 she was awarded the degree of Master of Business Administration with a concentration in Accounting. In January, 1970 she began teaching in the Accounting Department at Bryant College where she is tenured and holds the rank of Assistant Professor. In the Summer of 1971, she enrolled in the Graduate School of Louisiana State University in Baton Rouge, Louisiana where she is currently a candidate for the Doctor of Philosophy degree in the Department of Accounting.

EXAMINATION AND THESIS REPORT

Candidate: Janice A. Smith

Major Field: Accounting

Title of Thesis: The Measurement of Investment Center Managerial Performance within Selected Diversified Industrial Firms: An Inquiry

Approved:

O. K. Leavitt

Major Professor and Chairman

James L. Ingraham

Dean of the Graduate School

EXAMINING COMMITTEE:

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Date of Examination:

August 6, 1975